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A REVISION OF THE GENUS *IXIAS* HÜBNER (LEPIDOPTERA: PIERIDAE)

By A. G. Gabriel.

(*Dept. of Entomology, British Museum (Nat. Hist.).*)

The classification of the genus *Ixias* Hübner has hitherto presented considerable difficulty owing to the fact that types and rare specimens have been scattered among many collections.

The acquisition by the British Museum, in recent years, of many important collections has brought together more than 3000 specimens of the genus, including about 70 holotypes, allotypes and paratypes with the result that practically every known form is now represented in one collection, in many cases by considerable numbers of specimens.

Ixias is known to occur in the Andamans, Ceylon, India, Burma, Siam, Cambodia, Indo-China, China, Formosa, Hainan, the Malay Peninsula and most of the islands of the East Indies.

The examination of this considerable material has convinced the writer that several forms usually regarded as distinct species are, in reality, geographical races of a single species *pyrene* Linn.

The position appears to be that, apart from some obvious geographical differentiation, two forms occur in both sexes—those with yellow and those with white ground-colour and these two colour forms are distributed throughout the range of the *pyrene* group in a manner which is unusual so far as oriental Rhopalocera are concerned. If this colour dimorphism were confined to the female sex it would not be surprising, but such dimorphism in both sexes is rare and a dimorphism producing yellow and white males in the Pieridae seems to be remarkable.

If the yellow and white forms are regarded as separate species the distribution of either is unusual thus :—

Yellow form—Ceylon, India (including Burma west of the River Salween), Cochin China, Tonkin, North Annam, Hainan, China, Formosa, Malaya (south of Kedah), Java, Borneo, Mindanao.

White form—Andamans, Burma (east of the river Salween), Tenasserim, Siam to Kedah, South Annam, Sumatra.

but assuming that the two forms are geographical subspecies, it may be expected that intermediate forms will occur where the areas of the two colour forms adjoin, and there are many specimens in the British Museum from such areas with pale-yellowish ground-colour which must be regarded as intermediate between the two forms. In this connection Dr. A. S. Corbet suggests that it would be of interest if specimens were collected in Malaya between the areas occupied by the white form *verna* and the yellow form *birdi*, or at altitudes between 1000 and 3000 feet.

Some authors have regarded the size of the fore-wing subapical orange patch of the male as a character for the separation of some of the *pyrene* forms, but care is necessary in making such comparisons, as this patch varies in size according to the season, the wet-season forms showing an extension of the

brownish-black surrounding area with a corresponding decrease in size of the orange patch.

The females of *Ixias* are extremely variable in size and coloration, but the most remarkable is *undatus* which occurs in Borneo and, although the male is like a rather large *pyrene* form, the female is quite unlike any other in the genus. It bears a striking superficial resemblance to the female of *Prioneris cornelia* Voll., which also occurs in Borneo.

The difference in size between the seasonal forms is considerable, the wet-season forms sometimes having an expanse of wings from 20 to 25 millimetres greater than that of the dry-season forms.

I am indebted to Dr. A. S. Corbet for the following note on the habits of *Ixias* in Malaya :—" The white form *verna* in North Kedah occurs in secondary growth and is rather strong in flight; yellow *birdi* is confined to primary forest on the plains in Malaya proper, where it is rather slow on the wing, flies near the ground, and is more localised than is usual in Malayan Rhopalocera; white *alticola* is known only from rather open forest on Cameron Highlands and Fraser's Hill, at altitudes above 3500 feet, and is a stronger and higher flyer than *birdi*. While no case has been recorded of a species having different habits on the hills and plains in Malaya proper, there are several instances of butterflies showing different behaviour in North Kedah and Malaya proper : for instance, *Papilio coon* (F.) and *Lebadea martha* (F.) are rather localised denizens of primary forest in the Peninsula, while they are common insects in secondary growth in North Kedah."

The genitalia of both yellow and white *pyrene* forms appear to be identical with each other and also with such *Ixias* forms as *vollenhovii* Wall., *malum-sinicum* Thieme and *flavipennis* Gr.-Sm. whose claim to specific rank can hardly be questioned.

Such similarity in genitalia, however, among allied species is by no means unusual among the PIERIDAE.

Male androconial scales are present in *Ixias*, but these do not differ from one species to another.

The early stages of the south Indian race *sesia* Fab. have been described by T. R. Bell and the larvae have been found on several species of *Capparis* (Capparidaceae), but otherwise little is known, and it is very desirable that the yellow and white forms of *pyrene* should be bred and the early stages described.

The unwisdom of using the name of a locality for a specific or form name is well illustrated by *yunnanensis* having to be used for Tonkin specimens, and *moulmeinensis* for a form which does not occur at Moulmein.

In the systematic list which follows it has been considered unnecessary to give descriptions of the commoner forms, but references are given, almost all of which have been verified, to original descriptions and to easily accessible publications, where descriptions and figures may be consulted. Other references to the literature of the genus will be found in Talbot, 1932–5, in Junk, *Lep. Cat. Pieridae.*

New names have not been proposed for seasonal or female forms as similar types of these forms tend to occur in the different subspecies, but names already available have been indicated.

Dr. A. S. Corbet has kindly examined the genitalia of many specimens, and both he and Brigadier W. H. Evans have been ever ready to place their great knowledge of the butterflies of Malaya and India respectively, at my disposal.

Ixias Hübner.

Ixias Hübner, 1819, *Verz. bek. Schm.* (6) : 95.

Type *Papilio pyrene* Linnaeus.

Ixias marianne marianne Cramer.

Papilio marianne Cramer, 1779, *Pap. Exot.* **3** : 41, pl. 217, ff. cd ♀, e ♂, Coromandel.
Thestias agnivena Moore, 1877, *Ann. Mag. nat. Hist.* (4) **20** : 50. ♂ Bombay, ♀ Mynpooree.
Ixias depalpura Butler, 1883, *Proc. zool. Soc. Lond.* **1883** : 153, pl. 24, ff. 6, 7. ♂♀, Depalpore.
Ixias cumballa Swinhoe, 1885, *Proc. zool. Soc. Lond.* **1885** : 141, pl. 9, ff. 13, 14. ♂♀, Bombay.
Ixias meridionalis Swinhoe, 1885, *Proc. zool. Soc. Lond.* **1885** : 140, pl. 9, f. 5. ♂♀, Poona.
Ixias marianne (Cramer) Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9**, pl. 72a, b.

Wet-season form *cumballa* Swinhoe; Intermediate form *marianne* Cramer = *meridionalis* Swinhoe; Dry-season form *agnivena* Moore = *depalpura* Butler. All three forms are figured in Seitz (*loc. cit.*) and an interesting aberration is figured by E. E. Green, 1913, *Spolia Zeyl.* **9** : pl. 2, f. 9.

The type specimens of all the above-mentioned forms are in the British Museum with the exception of *marianne*.

The male genitalia differ slightly from *pyrene*, the uncus having a small projection.

Punjab; United Provinces; Nepal; C. and S. India; Ceylon.

Ixias marianne nola Swinhoe.

Ixias nola Swinhoe, 1889, *Proc. zool. Soc. Lond.* **1889** : 399. ♂♀, Mahableshwar.
Ixias nola Swinhoe, 1910, *Lep. Ind.* **7** : 117, pl. 590, ff. a–e. ♂♀, Mahableshwar.
Ixias marianne f. *nola* (Swinhoe) Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 160, pl. 72b. ♀, Mahableshwar.
Ixias marianne f. *nola* (Swinhoe) Talbot, 1939, *Fauna Brit. India Rhop.* **1** : 442. ♂♀.

Described as a separate species with seasonal forms but considered as the dry-season form of *marianne* by Fruhstorfer (*loc. cit.*) and Talbot (*loc. cit.*).

The examination of more than 50 specimens shows that *nola* is subject to considerable seasonal variation and that Swinhoe was correct in distinguishing wet- and dry-season forms. Both forms are well described and figured by Swinhoe (*loc. cit.*).

The male holotype and female allotype are in the British Museum. The male genitalia do not differ from typical *marianne*.

N. Bombay—Mahableshwar Mts.

Ixias pyrene cingalensis Moore.

Ixias cingalensis Moore, 1881, *Lep. Ceylon* **1** : 126, pl. 50, ff. 2 ♂, 2a ♀. Ceylon.
Ixias pyrene cingalensis (Moore) Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 159. ♂♀, Ceylon.
Ixias pyrene cingalensis (Moore) Ormiston, 1924, *Butt. Ceylon* : 92. ♂♀, Ceylon.

May be distinguished from the continental forms by the narrower fore-wing subapical band of both sexes. Two female forms may be distinguished. (1) Upperside : ground-colour greenish-yellow, fore-wing subapical band of spots greenish-yellow. (2) Upperside : ground-colour greenish-yellow, fore-wing subapical band of spots reddish-orange.

Fruhstorfer (*loc. cit.*) has described two female forms on the evidence of single specimens—*nivescens* with white ground-colour and a *broad* subapical band, and *connectens* with yellow ground-colour and a *broad* subapical band of the same colour. It is very doubtful whether these two specimens came from Ceylon as females of *cingalensis* are characterised by a narrow discontinuous fore-wing band and a yellowish ground-colour.

Ormiston, who had a long experience of collecting in Ceylon, says "the ground colour of the females is always yellow." These two females, which agree well with those of the race *sesia*, probably came from S. India.

The types of all the above-mentioned forms are in the British Museum.

Ceylon.

Ixias pyrene sesia Fabricius.

Papilio sesia Fabricius, 1777, *Gen. Ins.* : 257. ♂ ("America"); S. India.
Thestias pirenassa Wallace, 1867, *Trans. ent. Soc. Lond.* (3) **4** : 395, pl. 9, f. 4. ♂♀, Madras.
Ixias frequens Butler, 1880, *Proc. zool. Soc. Lond.* **1880** : 151, pl. 15, ff. 6, 7. ♂♀, Bengal.
Ixias ganduca Moore, 1884, *J. Asiatic Soc. Beng.* **53** : 29. ♂, Calcutta.
Ixias colaba Swinhoe, 1885, *Proc. zool. Soc. Lond.* **1885** : 142, pl. 9, f. 6. ♂, Bombay.
Ixias jhoda Swinhoe, 1885, *Proc. zool. Soc. Lond.* **1885** : 142, pl. 9, ff. 3, 4. ♂♀, Bombay.
Ixias alana Swinhoe, 1890, *Ann. Mag. nat. Hist.* (6) **5** : 357. ♂♀, Maldah.
Ixias pyrene cingalensis f. *nivescens* Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 159, pl. 71d. ♀ ("Ceylon"); S. India.
Ixias pyrene cingalensis f. *connectens* Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 159, pl. 71d. ♀ ("Ceylon"); S. India.

The type of *sesia* Fabricius is still preserved in the Banks collection now in the British Museum. It is a male of the wet-season form and undoubtedly came from S. India. The locality given by Fabricius (*loc. cit.*) is, of course, erroneous.

Wet-season form *sesia* Fabricius = *frequens* Butler = *colaba* Swinhoe = *alana* Swinhoe; Intermediate form *pirenassa* Wallace; Dry-season form *ganduca* Moore = *jhoda* Swinhoe.

The females exhibit great variation particularly in the colour of the fore-wing subapical band, but three principal forms may be distinguished. ♀ f. *nivescens* Fruh. (*loc. cit.*). Upperside and underside of both wings ground-colour white; fore-wing subapical band white. ♀ f. *connectens* Fruh. (*loc. cit.*). Upperside and underside of both wings ground-colour greenish-yellow; fore-wing subapical band greenish-yellow. A third ♀ form has a greenish-yellow ground-colour and an orange fore-wing subapical band.

An extreme wet-season form occurs in Mysore in which the fore-wing subapical band is reduced in both sexes and the brownish-black surrounding area correspondingly extended. The female has a marginal band from 7 to 8 mm. in width on the hind-wing and the brownish-black area almost fills the fore-wing cell.

The type specimens of all the above-mentioned forms are in the British Museum with the exception of *ganduca*.

The early stages are described and figured by T. R. Bell, 1913, *J. Bombay nat. Hist. Soc.* **22** : 320, pl. j.

Western and Southern India.

Ixias pyrene kausala Moore.

Ixias kausala Moore, 1877, *Ann. Mag. nat. Hist.* (4) **20** : 49. ♂♀, Kausali, N.W. Himalaya.
Ixias satadra Moore, 1877, *Ann. Mag. nat. Hist.* (4) **20** : 50. ♂, Simla.
Ixias dharmsalae Butler, 1880, *Proc. zool. Soc. Lond.* **1880** : 150, pl. 15, ff. 8, 9. ♂♀, Dharmsala.
Ixias watti Butler, 1880, *Proc. zool. Soc. Lond.* **1880** : 151, pl. 15, f. 1. ♂ ("Bengal") N.W. Himalaya.
Ixias pygmaea Moore, 1882, *Proc. zool. Soc. Lond.* **1882** : 254, pl. 12, f. 1. ♂, Kangra.
Ixias satadra (Moore) Swinhoe, 1909, *Lep. Ind.* **7**, pl. 580, f. 1b.

Characterised by the marginal band of the hind-wing tending to become macular in the wet and intermediate forms of both sexes.

Examination of the type of *satadra* shows it to be an extreme wet-season form with a much reduced subapical band of six well-defined reddish-orange spots on the upperside of fore-wing. It is figured by Swinhoe (*loc. cit.*).

Butler's figure of *watti* (*loc. cit.*) does not well represent the type specimen which has a much broader marginal band on the upperside of hind-wing.

Wet-season form *satadra* Moore = *watti* Butler; Intermediate form *dharmsalae* Butler; Dry-season form *kausala* Moore = *pygmaea* Moore.

The females are very variable but two forms may be distinguished. (1) Upperside: both wings ground-colour greenish-yellow; fore-wing subapical band varying from greenish-yellow to pale reddish-brown. (2) Upperside: both wings ground-colour white; fore-wing subapical band white. Both forms are heavily dusted with blackish scales.

A fine series of females in the British Museum from Miramshah, N.W. Frontier Province, collected by Lt.-Col. H. D. Peile, well illustrates the variation in colour of the fore-wing subapical band.

The types of all the above-mentioned forms are in the British Museum.

Baluchistan; Chitral; N.W. Frontier Province; United Provinces.

Ixias pyrene familiaris Butler.

Ixias familiaris Butler, 1874, *Trans. ent. Soc. Lond.* **1874** : 432. ♀ (" Tibet ") Sikkim.
Ixias pyrene rhexia (Fabricius) Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 159, pl. 71b ♂, 71c ♀.

The type specimen is a female with a reduced subapical band of white spots on the upperside of the fore-wing and a hind-wing marginal band which extends to the cell.

Wet-season form *familiaris* Butler. Both sexes of the wet-season form are figured in Seitz (*loc. cit.*) under the name *rhexia*.

The contrast in size between the wet- and dry-season forms is remarkable, the average expanse of wings of the former being 80 mm. and the latter 54 mm.

Two female forms may be distinguished. (1) Upperside ground-colour white; fore-wing subapical band white. (2) Upperside ground-colour white; fore-wing subapical band varying in colour from yellow tinged with orange to bright reddish-orange.

A remarkable albino male is in the British Museum (ex Hewitson Coll.). The upperside and underside ground-colour is white dusted with black scales, and the subapical band is also white. The specimen is without locality but it probably came from Sikkim or Assam.

The name *rhexia*, used by several authors for this N. Indian race of *pyrene*, was originally given by Fabricius to a specimen of *Colotis* (*Teracolus*) from Sierra Leone (Watkins, 1923, *Entomologist* **53** : 207).

The type specimens of both the above-mentioned forms are in the British Museum.

Nepal; Sikkim; Assam.

Ixias pyrene latifasciatus Butler.

Ixias latifasciatus Butler, 1871, *Proc. zool. Soc. Lond.* **1871** : 252. ♂ *nec* ♀ (" Moulmein ").
Ixias moulmeinensis Moore, 1878, *Proc. zool. Soc. Lond.* **1878** : 837. ♂♀, Moulmein to Meetan.
Ixias meipona Grose-Smith, 1887, *Ann. Mag. nat. Hist.* (5) **19** : 296. ♂, Burma.

Butler described under the name *latifasciatus* a male with yellow ground-colour and a female with white ground-colour. These specimens are labelled " E. Indies, Moulmein 1843 ", and the female agrees well with other females from that locality. The usual form of male from Moulmein, however, has a white ground-colour and it therefore seems reasonable to assume that the male specimen described by Butler was not captured at Moulmein but somewhere to

the west of it, possibly in the Rangoon area. The name *latifasciatus* will therefore be valid for the yellow form which occurs in Burma as far east as the Karen Hills and south to Martaban and the lower Salween river.

Several authors have separated *pyrene* from southern Burma under the name *meipona*, giving as characters the pale yellow ground-colour and the restriction of the reddish-orange marking to the upper angle of fore-wing in the male, but the examination of more than one hundred specimens does not support this separation. The very slight difference in the ground-colour appears to be seasonal, the dry-season forms being sometimes a little paler, while individuals with and without the orange marking in the lower angle of fore-wing cell occur in both southern and northern Burma.

More material is desirable from extreme eastern and northern Burma, but on the available evidence it seems probable that a single subspecies inhabits the area from the Mishmi Hills and Manipur eastwards to the Karen Hills.

Wet-season form *latifasciatus* Butler; Intermediate form *meipona* Grose-Smith; Dry-season form *moulmeinensis* Moore.

The types of all the above-mentioned forms are in the British Museum.

East Assam and Burma (west of the River Salween).

Ixias pyrene yunnanensis Fruhstorfer.

Ixias pyrene yunnanensis Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 158. ♂, Yunnan.
Ixias pyrene tonkiniana Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 158, f. 71c. ♂♀, Tonkin.
Ixias pyrene tonkiniana f. *denigrata* Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 159, f. 71e. ♂, Tonkin.

Fruhstorfer described under the name *yunnanensis* female specimens with a reddish instead of a yellowish fore-wing subapical band and a hind-wing with a reddish suffusion at its base. Examination shows that this band is by no means always reddish; in fact it varies from reddish-orange to yellowish-white and only half a dozen of the 25 females from Yunnan before me show any trace of the reddish suffusion at the base of hind-wing. The real difference between *yunnanensis* and *latifasciatus* is in the larger brownish-orange subapical fore-wing patch of the males of the former.

Specimens from Tonkin are said by Fruhstorfer (*loc. cit.*) to differ from those from Yunnan, the male having a smaller fore-wing subapical patch and very broad dark bands. The type specimen of *tonkiniana* certainly has a reduced fore-wing orange subapical patch, but examination of more than 20 males, including paratypes, shows that the type is an abnormal specimen and that the fore-wing patch is usually as large in *tonkiniana* as in *yunnanensis*. The brownish-black marginal bands are characteristic of extreme wet-season forms from both localities.

tonkiniana can be regarded as an aberration with a restricted fore-wing patch.

Wet-season form *yunnanensis* Fruh.; Dry-season form *denigrata* Fruh.

The ground-colour of the females varies from greenish-yellow to white and the subapical band on upperside of fore-wing varies in colour from reddish-orange to yellowish-white.

The types of all the above-mentioned forms are in the British Museum.

Yunnan; Tonkin.

Ixias pyrene verna H. Druce.

Ixias verna H. Druce, 1874, *Proc. zool. Soc. Lond.* **1874** : 108, pl. 16, ff. 5♂, 6♂. Nahcomhaisee, Siam.
Ixias pallida Moore, 1878, *Proc. zool. Soc. Lond.* **1878** : 837. ♂, Moolai, Upper Tenasserim.
Ixias citrina Moore, 1878, *Proc. zool. Soc. Lond.* **1878** : 837. ♂, Upper Tenasserim.

Differs from the preceding forms as follows: ♂♀. Upperside ground-colour white or tinged with yellowish-white; the subapical fore-wing patch of the male dull-orange, usually sparsely dusted with black scales; the basal area of both wings thickly dusted with blackish scales. The usual form of female has a reddish-orange subapical band on upperside of fore-wing, but a second and apparently less common form occurs in which this band is yellowish-white.

Wet-season form *pallida* Moore; Intermediate form *verna* H. Druce = *citrina* Moore. The dry-season form has only a trace of the brownish-black marginal band on the upperside of hind-wing.

The types of the above-mentioned forms are in the British Museum.

The genitalia do not differ from the preceding *pyrene* forms.

Dr. A. S. Corbet informs me that *verna* is found in open secondary growth in North Kedah.

Burma (Dawnas); Tenasserim (east of River Salween); Siam; Malaya.

Ixias pyrene andamana Moore.

Ixias andamana Moore, 1877, *Proc. zool. Soc. Lond.* **1877** : 590. ♂♀, S. Andamans.
Ixias lena Swinhoe, 1890, *Ann. Mag. nat. Hist.* (6) **5** : 357. ♂♀, Andamans.
Ixias pyrene andamana (Moore) Fruhstorfer, 1910, *Gross-Schmett. Erde* **9** : 159. ♂♀, Andamans.

Moore's description (*loc. cit.*) of the male gives the ground-colour of the upperside as pale primrose-yellow but examination of the type specimen shows that this yellow colour is almost imperceptible and that the true ground-colour is a dirty-white. The females appear to be much less variable than those of the preceding forms; all apparently have a fairly uniform white ground-colour and a reddish-orange fore-wing subapical band of spots.

Judging by the considerable number examined, the tendency to a primrose-yellow suffusion is more pronounced in specimens of intermediate and dry-season forms.

Fruhstorfer says (*loc. cit.*) that *lena* is an " extreme dry season form," but the type specimen is a large male (expanse of wings 69 mm.) with a marginal band on upperside of hind-wing 4 mm. in width. The true dry-season form, however, is much smaller (expanse of wings 58 mm.) with a hind-wing band 1–2 mm. in width.

All three forms are figured by Swinhoe, 1909, *Lep. Ind.* **7**, pl. 586.

Wet-season form *andamana* Moore; Intermediate form *lena* Swinhoe.

The types of *andamana* and *lena* are in the British Museum.

Andaman Isles.

Ixias pyrene fruhstorferi ssp. n.

Fruhstorfer, when collecting in Annam, found that a yellow form of *pyrene* occurs in the north and white form in the south. The yellow form is very similar to *latifasciatus* Butler, but as slight differences may be discerned it may be well to distinguish it as follows.

Somewhat smaller than *latifasciatus*. ♂. Upperside: both wings ground-colour lemon-yellow; base of wings thickly dusted with blackish scales, particularly the fore-wing, which extends over the whole of the discoidal cell in some specimens; apical half of fore-wing brownish-black with a well-defined dull-orange subapical patch. The hind-wing has a brownish-black marginal band varying in width as in the other *pyrene* forms.

♀. Both wings ground-colour lemon-yellow; apical half of fore-wing and outer two-thirds of cell brownish-black; a subapical orange band. The hind-wing has a brownish-black marginal band of varying width.

The underside does not differ from *latifasciatus*.

The male may be distinguished by the more extensive dusting at the base of wings and the paler colour of the orange subapical patch. The female does not appear to differ from *latifasciatus*.

B.M. Holotype ♂ No. 15039 N. Annam, Phuc-Son, Nov.–Dec. (H. Fruhstorfer). B.M. Allotype ♀ No. 15040 N. Annam, Phuc-Son, Nov.–Dec. (H. Fruhstorfer).

Ixias pyrene annamitica Fruhstorfer.

Ixias pyrene ♀ form *annamitica* Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 159, pl. 72a. ♀, S. Annam.

In the southern districts of Annam a form occurs which is very similar to *verna* H. Druce, but the dull-orange patch on upperside of fore-wing in the male is larger, *i.e.*, its outer edge is more nearly parallel to the outer margin of the wing. The name *annamitica* given by Fruhstorfer to the female may therefore be used for this " white " race of *pyrene*.

Specimens of both sexes occur with a pale yellow tinge on upperside and are probably transition forms.

The ground-colour of the type specimen, now in the British Museum, is considerably paler than the figure in Seitz (*loc. cit.*).

South Annam.

Ixias pyrene hainana Fruhstorfer.

Ixias pyrene hainana Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 158. ♂, Hainan.
Ixias pyrene hainana f. aest. *maculosa* Joicey & Talbot, 1924, *Bull. Hill Mus.* **1** : 529. ♂♀, Interior of Hainan.

One of the largest of the *pyrene* forms, some specimens of the wet-season form having an expanse of wings of 71 mm. The subapical ochreous-yellow patch on the upperside of fore-wing in the male is also very large and extends over the apical third of the cell. The dry-season form is much smaller and has only a trace of the marginal band on hind-wing.

Intermediate form *hainana* Fruhstorfer; Dry-season form *maculosa* Joicey & Talbot.

Two female forms are known—(1) ground-colour greenish-yellow; fore-wing subapical band of the same colour; (2) ground-colour greenish-yellow, fore-wing subapical band reddish-orange.

The types of *hainana* and *maculosa* are in the British Museum.

Hainan.

Ixias pyrene pyrene Linnaeus.

Papilio pyrene Linnaeus, 1764, *Mus. Lud. Ulr. Reg.* : 241. ♂, S.E. China (probably Canton).
Papilio pirithous Fabricius, 1775, *Syst. Ent.* : 483. ♀ (" America boreali "), S. China.
Papilio aenippe Cramer, 1776, *Pap. Exot.* **2** : 13, pl. 105, ff. c, d. ♀, China.
Ixias pirithous (Fabricius) Watkins, 1923, *Entomologist* **56** : 208. ♂♀, S. China.
Ixias pyrene pyrene (Linnaeus) Seitz, 1910, *Gross-Schmett. Erde* **9** : pl. 71.

The type specimen of *pyrene*, a male with an expanse of wings of 66 mm., has a narrow brownish-black band on the upperside of the hind-wing and may be considered as the intermediate form.

The type specimen of *pirithous* is a female, erroneously described as from America borealis, which almost certainly came from S. China.

aenippe is, according to the figure (*loc. cit.*), a female of the intermediate form with an expanse of wings of 64 mm.

Wet-season form *pirithous* Fabricius; Intermediate form *pyrene* Linnaeus = *aenippe* Cramer. Both forms are figured in Seitz (*loc. cit.*). The dry-season form is figured under the name *aenippe*.

The ground-colour of the female varies, on the upperside, from white to pale-yellow.

The type of *pyrene* is in the collection of the Linnean Society of London and that of *pirithous* in the British Museum.

S. China.

Ixias pyrene insignis Butler.

Ixias insignis Butler, 1879, *Cist. Ent.* **2** : 431, pl. 8, f. 1. ♂, Tai-wan-foo, Formosa.
Ixias pyrene insignis f. *reducta* Paravicini, 1913, *Suppl. Ent.* **2** : 74. ♂♀, Formosa.
Ixias pyrene insignis f. *intermedia* Paravicini, 1913, *Suppl. Ent.* **2** : 74. ♂, Formosa.
Ixias splendida Swinhoe, 1916, *Ann. Mag. nat. Hist.* (8) **18** : 481. ♂, Polisha, Formosa.
Ixias pyrene insignis ab. *pallida* Nire, 1917, *Dobuts Z. Tokyo* **29** : 145. ♂, Formosa.
Ixias pyrene insignis ab. *breviptila* Sonan, 1926, *Tr. nat. Hist. Soc. Formosa* **16** : 180. ♂, Hohisha.
Ixias pyrene reducta ab. *hassenzana* Nomura, 1931, *Mushi* **4** : 10, pl. 2, f. 2. ♂, Formosa.
Ixias pyrene reducta ab. *uchidai* Tanaka, 1938, *Zephyrus* **8** : 17, pl. 16, f. 4. ♂, Formosa.

A very distinct subspecies. The male has, on the upperside, greenish-yellow ground-colour and a large reddish-orange subapical patch on the fore-wing which extends to the apical half of the cell.

The only known female form has the upperside white ground-colour thickly dusted with brownish-black scales and a white subapical band on the fore-wing.

insignis Butler is the wet-season form with broad brownish-black markings on the upperside of both wings in both sexes. Average expanse of wings 65 mm. For the intermediate form, *intermedia* Parav. may be used. It has the brownish-black marginal band on the upperside of hind-wing broken into spots. Average expanse of wings 59 mm. *reducta* Parav. = *splendida* Swinh. = *breviptila* Sonan is the dry-season form characterised by the brownish-black band along the lower margin of the orange subapical patch of the fore-wing being almost obsolete in both sexes. Average expanse of wings 56 mm.

pallida Nire appears from the description (*loc. cit.*) to be a male aberration with the ground-colour of the wings creamy and a white instead of orange fore-wing subapical patch.

uchidai Tanaka appears to be a slightly aberrant male of the dry-season form in which the outer edge of the reddish-orange subapical patch is yellowish.

hassenzana Nomura is, judging by the figure (*loc. cit.*), an aberrant male of the dry-season form with the reddish-orange subapical patch of the fore-wing dusted over with dark scales.

The types of *insignis* Butler and *splendida* Swinhoe are in the British Museum.

Formosa.

Ixias pyrene salangana Fruhstorfer.

Ixias pyrene salangana Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 159, pl. 72c. ♂, Salanga.

Fruhstorfer's description is very brief but it is accompanied by a figure of the upperside which shows the ground-colour more strongly tinged with yellow than is the case with the actual type specimen which is now in the British Museum.

♂. Upperside: basal half of fore-wing white, thickly dusted with greyish-black scales at the base of wing; apical half of wing brownish-black with a large dull-orange subapical

patch which is also dusted with brownish-black scales. Hind-wing: ground-colour dirty-white faintly tinged with yellow; base of wing dusted with brownish-black scales; a brownish-black marginal band 5 mm. in width. Underside: both wings pale-yellow; the upperside markings faintly outlined; a brownish-black spot at tornus of the fore-wing.

♀. Unknown to me.

Salanga Id.; West coast of Malaya.

Ixias pyrene alticola Pendlebury.

Ixias ludekingi alticola Pendlebury, 1933, *Journ. F.M.S. Mus.* **17** : 383. ♂, Lubok Tamang, Pahang.
Ixias ludekingi alticola Corbet & Pendlebury, 1934, *Butt. Malay Pen.* : 102, pl. 4, ff. 40 ♂, 41 ♀.

One of the very few " white " forms of *pyrene* with the upperside ground-colour of both sexes entirely without trace of yellow scales.

The male is unusual in that the inner brownish-black border of the orange subapical band is very broad and occupies the whole costal area and apical half of the fore-wing cell.

The only known female form has the upperside ground-colour white and a fore-wing subapical band of the same colour.

The holotype male was taken at Lubong Tamang (3500 ft.) and the female allotype at Fraser's Hill (4200 ft.). Both specimens are in the British Museum.

Apparently a rare form occurring according to Corbet and Pendlebury (*loc. cit.*) " in open spaces on certain forested hills."

Pahang, F.M.S.

Ixias pyrene birdi Distant.

Ixias birdi Distant, 1883, *Ann. Mag. nat. Hist.* (5) **12** : 351. ♂, Sungei Ujong, Malaya.
Ixias birdi Distant, 1883, *Rhop. Malay.* : 309, pl. 26, f. 4. ♂, Sungei Ujong, Malaya.
Ixias pyrene birdi (Distant) Corbet & Pendlebury, 1934, *Butt. Malay Pen.* : 102. ♂♀.

The male of this very local form is distinguished by a comparatively narrow orange band and a large blackish-brown apical area on the upperside of fore-wing. The female has the ground-colour and the fore-wing subapical band pale-yellowish.

Both sexes are described by Corbet and Pendlebury (*loc. cit.*), who state that the butterfly flies in forest glades on the plains.

Malaya south of Kedah.

Ixias pyrene weelei Eecke.

Thestias weelei Van Eecke, 1912, *Notes Leiden Mus.* **34** : 80. ♀, Sabang Id.
Ixias ludekingi wahri Kalis, 1933, *Tijd. Ent.* **76** : 76. ♂♀, Sabang Id.

♂. Upperside: fore-wing; apical half brownish-black; a restricted dull-orange apical band measuring 8 mm. at its greatest width; basal half of wing white faintly tinged with yellow. Hind-wing: ground-colour white, faintly tinged with yellow; a brownish-black marginal border 5 mm. in width, narrowing somewhat towards the tornus. Base of both wings thickly dusted with black scales. Underside: fore-wing rather pale sulphur-yellow, becoming almost white towards the lower margin; a brownish-black spot at the tornus.

♀. Unknown to me, but according to the description the upperside ground-colour is yellowish-white and the fore-wing subapical band of orange-yellow is short and narrow.

wahri appears from the description to be a synonym.

A single male specimen is in the British Museum.

Sabang Id., N. of Sumatra.

Ixias pyrene ludekingii Vollenhoven.

Thestias ludekingii Vollenhoven, 1860, *Tijd. Ent.* **3** : 126. ♂, Sumatra (interior).
Ixias ludekingi (Voll.) Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 159, pl. 72c. ♂♀.
Ixias ludekingi ab. *nigrobasalis* Joicey & Talbot, 1928, *Bull. Hill Mus.* **2** : 19. ♂, Padang Pandjang.

The fore-wing subapical band of the male is said to be reddish-orange in the original description (*loc. cit.*) and Fruhstorfer (*loc. cit.*) says it is yellowish, although in his figure the colour is orange. Examination of more than 50 specimens shows that this band is a dull-orange colour and that it varies in width from 7 to 12 mm.

The only known female form has the ground-colour and fore-wing subapical band white. It is apparently rare.

nigrobasalis Joicey & Talbot is a rather remarkable male aberration with the basal half of the fore-wing strongly dusted with blackish scales. The type specimen is in the British Museum.

Sumatra.

Ixias pyrene balice Boisduval.

Thestias balice Boisduval, 1836, *Spec. Gen. Lep.* **1** : 593. ♂, Java.
Ixias balice (Boisduval) Fruhstorfer, 1894, *Berl. ent. Z.* **39** : 246. ♀, Java.
Ixias balice (Boisduval) Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 159, pl. 72c. ♂♀, Java.

Characterised by the absence of the brownish-black line which divides the orange subapical patch on the upperside of the fore-wing from the ground-colour in the other male forms of *pyrene*.

The female appears to be very rare and only one form is known. This has the ground-colour and the fore-wing subapical patch greenish-yellow.

Both sexes are figured in Seitz (*loc. cit.*).

Java.

Ixias pyrene clarki Avinoff.

Ixias clarki Avinoff, 1926, *Ann. Carnegie Mus.* **16** : 360, pl. 30, f. 3. ♂, Baguio, Luzon, 5000 ft.

A striking form of which only the male is known.

Upperside : fore-wing brownish-black, inner third of wing pale primrose-yellow which just enters the cell ; an orange patch centred about the lower angle of the cell and occupying almost the apical half of it. Hind-wing basal half pale primrose-yellow except the extreme base of wing which is brownish-black ; outer half of the wing brownish-black. Underside : both wings greenish-yellow ; a triangular brownish-black spot at the fore-wing tornus and a submarginal row of spots of the same colour on the hind-wing. Expanse of wings 60 to 62 mm.

Philippine Is.—Luzon and Mindanao.

Ixias undatus Butler.

Ixias undatus Butler, 1871, *Proc. zool. Soc. Lond.* **1871** : 252, pl. 19, f. 4. ♂, Labuan.
Ixias pyrene undatus (Butler) Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 159, pl. 71b. ♂, Borneo.
Ixias pyrene undatus (Butler) Fruhstorfer, 1911, *Ent. Rundsch.* **28** : 186. ♀, Borneo.

This striking form, of which only the male was known for many years, has been considered as the Bornean race of *pyrene* by several authors. The female

is, however, quite unlike any other female in the genus, and for this reason it is given specific rank. It bears a strong superficial resemblance to the female of *Prioneris cornelia* Voll., which also occurs in Borneo.

The male holotype is in the British Museum.

Borneo.

Ixias malumsinicum adamsi ssp. n.

♂. Upperside: fore-wing ground-colour brownish-black; a large discal orange marking extending from the costa to the submedian and occupying the apical third of the discoidal cell; a brownish-black marginal band which broadens towards the apex of the wing; a bluish-grey stripe between the submedian vein and the inner margin of the wing. Hind-wing: creamy-white tinged with pale yellow; a brownish-black marginal band 3 mm. in width. Underside: both wings pale greenish-yellow with numerous fine brown lines and minute spots; a dark-brown spot at the middle discocellular.

Differs from the typical form in the paler and more restricted orange marking on the upperside of the fore-wing and the yellowish hind-wing.

West Sumatra: Batang Proepoe, Padang Bovenland, 1600 ft., Sept.–Dec. 1897 (ex coll. van de Poll and coll. H. J. Adams).

B.M. ♂ holotype No. Rh. 15041.

Ixias malumsinicum malumsinicum Thieme.

Ixias malumsinicum Thieme, 1896, *Berl. ent. Z.* **41** : 408. ♂, Nias.
Ixias malumsinicum (Thieme) Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 159, pl. 72c. ♂♀,

The male is characterised by the size of the orange marking on the upperside which occupies the whole fore-wing except for a brownish-black marginal band and a cream-coloured stripe between the submedian vein and the inner margin.

The only known female form has a yellowish-white ground-colour and an orange sub-apical band on the upperside of the fore-wing.

Nias.

Ixias venilia venilia Godart.

Pieris venilia Godart, 1819, *Enc. Méth.* **9** : 121. ♂♀, Java.
Ixias venilia (Godart) Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 160, pl. 72d. ♂♀, Java.
Ixias venilia ♀ form *kangeanensis* Joicey & Talbot, 1928, *Bull. Hill Mus.* **2** : 20. ♀, Kangean.
Ixias venilia ♀ form *piepersi* Roepke, 1935, *Rhop. Javan.* : 71, pl. 10, f. 15. ♀, Java.
Ixias venilia ♀ form *snelleni* Roepke, 1935, *Rhop. Javan.* : 71. ♀, Java.

A rather local form long thought to be confined to Java but now known to occur also in Kangean.

Female form *piepersi* Roepke (1935) does not appear to differ from female form *kangeanensis* Joicey & Talbot (1928). In any case the name is preoccupied by *Thestias* (now *Ixias*) *piepersii* Snellen (1878).

Three female forms are known :—

♀ f. typ. Upperside ground-colour yellow; fore-wing subapical band orange. ♀ f. *snelleni* Roepke (*loc. cit.*). Upperside ground-colour white; fore-wing subapical band orange. ♀ f. *kangeanensis* J. & T. Upperside ground-colour white; fore-wing subapical band white.

Type in the British Museum.

Java; Kangean.

Ixias venilia theresiae Kalis.

Ixias venilia theresiae Kalis, 1933, *Tijd. Ent.* **76** : 52. ♂, Sapoedi Id.

This form is unknown to me. It has been described on the evidence of two male specimens and is said to differ from typical *venilia* in having a much reduced orange subapical patch on the upperside of the fore-wing.

Sapoedi Id., Dutch E. Indies.

Ixias piepersii Snellen.

Thestias piepersii Snellen, 1878, *Tijd. Ent.* **21** : 31, pl. 2, ff. 1, 2. ♂♀, Bonthain.

Apparently very rare, being represented by only a single male specimen in the British Museum.

♂. Upperside : fore-wing greenish-yellow ; base of wing, including basal half of cell, thickly dusted with bluish-grey scales ; an orange patch which completely fills the apical half of the cell and extends somewhat beyond into the surrounding interspaces ; a submarginal band of brownish-black spots ; the outer margin of the wing has an irregular brownish-black band. Hind-wing greenish-yellow ; a brownish-black marginal band 6 mm. in width, narrowing towards the tornus. Underside : both wings sulphur-yellow with the upperside dark markings indistinctly outlined.

According to the figure (*loc. cit.*) the female is brownish-black on the upperside with a fore-wing submarginal band of indistinct yellow streaks. The basal half of the hind-wing is yellow strongly dusted with brownish-black scales.

S. Celebes.

Ixias reinwardtii javanensis Kalis.

Ixias reinwardti javanensis Kalis, 1933, *Tijd. Ent.* **76** : 67. ♂, Asembagoes, E. Java.

Unknown to me. According to the description (*loc. cit.*) the male has the upperside ground-colour white as in *baliensis* Fruh. but the orange patch on the fore-wing is as large as in *venilia* Godart. The female is similar to *baliensis* but the ground-colour of the upperside is somewhat darker ; the black marking on the fore-wing cell more strongly marked ; no orange marking on the fore-wing ; black margins of both wings broader, especially the hind-wing. Underside not mentioned.

E. Java.

Ixias reinwardtii kangeana Fruhstorfer.

Ixias reinwardti kangeana Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 160, pl. 72d. ♂, Kangean.

The male differs only slightly from *lombokiana* Fruh., the orange spot on the upperside of the fore-wing being slightly more restricted.

The female does not appear to have been described, so a description of a single female in the British Museum is given below.

Upperside : head and body black ; fore-wing : ground-colour brownish-black ; a dirty-white triangular area extending from the posterior margin and having its apex at the origin of the second median vein ; a white submarginal spot in interspaces 2 and 3 and a very small spot in interspaces 4 and 5 ; a white subapical marking consisting of 5 spots ; a white marking in interspace 3 at the origin of the second median vein. Hind-wing : ground-colour white, dusted with brownish-black scales especially at the base of the wing ; a brownish-black spot on the middle discocellular vein ; a brownish-black marginal border

6 mm. in width. Underside: both wings pale yellow with numerous minute brownish-black spots; a submarginal band of brownish-black spots. Expanse of wings 54 mm.

Similar to ♀ form *noctula* Fruh., but the pale areas on the upperside more extended.

B.M. Neallotype No. Rh. 15053.

The male holotype is in the British Museum.

Kangean.

Ixias reinwardtii baliensis Fruhstorfer.

Ixias baliensis Fruhstorfer, 1897, *Soc. Ent.* **12** : 49. ♂, Bali.
Ixias pulchrior Butler, 1898, *Ann. Mag. nat. Hist.* (7) **1** : 134. ♂♀, Bali.
Ixias baliensis (Fruhstorfer), Dixey, 1907, *Trans. ent. Soc. Lond.* **1906** : 521, pl. 31, f. 7. ♀, Bali.

The males are somewhat larger than the other forms of *reinwardtii*, having an expanse of wings from 58 to 61 mm. The black markings beyond the cell on the upperside of the fore-wing are less strongly indicated. Four female forms are represented in the British Museum. (1) ♀ f. *pulchrior* Butler (*loc. cit.*). Upperside: ground-colour white; fore-wing subapical band orange. (2) Upperside: ground-colour and the fore-wing subapical band white. This form is figured by Dixey (*loc. cit.*), who discusses its strong resemblance to the female of *Cepora corva* Wall. (3) Upperside: ground-colour white; fore-wing subapical band primrose-yellow. (4) Upperside: ground-colour greenish-yellow; fore-wing subapical band orange.

The type specimens of *baliensis* and *pulchrior* are in the British Museum.

Bali.

Ixias reinwardtii lombokiana Fruhstorfer.

Ixias reinwardti lombokiana Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 160, pl. 72e. ♂♀, Lombok.
Ixias reinwardti lombokiana ♀ form *noctula* Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 160, pl. 72e. ♀, Lombok.

Hardly differs from *baliensis*. The males from Bali and Lombok vary individually and the characters given by Fruhstorfer (*loc. cit.*) do not hold when a series is examined. The males of *lombokiana* are, however, somewhat smaller and the dark markings on the upperside are, on the whole, more pronounced.

Three female forms may be distinguished.

(1) ♀ f. typ. Upperside: ground-colour, fore-wing subapical band and the submarginal spots all yellow (fig. in Seitz (*loc. cit.*)). (2) ♀ f. *noctula* Fruh. Upperside almost entirely black (fig. in Seitz (*loc. cit.*)). An extreme wet-season form. (3) ♀ f. Upperside: ground-colour white; fore-wing subapical band and the submarginal spots white.

These female forms are very similar to those occurring on the islands Flores, Sumbawa, Alor and Timor, but in view of the differences in the males they may be regarded as distinct subspecies.

The type specimens of both *lombokiana* and *noctula* are in the British Museum.

Lombok.

Ixias reinwardtii extincta Röber.

Ixias reinwardti var. *extincta* Röber, 1900, *Ent. Nachr.* **26** : 200. ♂♀, Sumba.
Ixias reinwardti pagenstecheri Fruhstorfer (*nec* Röber), 1910, Seitz, *Gross-Schmett. Erde* **9** : 160. ♀, Sumba.

Both sexes of *extincta* are said by Röber (*loc. cit.*) to be smaller than typical *reinwardtii*, but the examination of a series does not support this difference, the males being similar to those of typical *reinwardtii*.

The only known female form has the upperside ground-colour and the fore-wing subapical band of spots white. The spots composing this band are longer than in the other female forms of *reinwardtii*.

Fruhstorfer (*loc. cit.*) uses the name *pagenstecheri* Röber for this form, but the reference given proves to be a description of *Cepora* (*Pieris*) *pagenstecheri* Röber and I am unable to discover that Röber described an *Ixias* under that name.

Sumba.

Ixias reinwardtii reinwardtii Vollenhoven.

Thestias reinwardtii Vollenhoven, 1860, *Tijd. Ent.* **3** : 126. ♂ ("Moluccas").
Ixias reinwardtii reinwardtii (Vollenhoven) Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 160, pl. 72e. ♂♀.

The underside of the hind-wing of the male is usually paler than in the other forms of *reinwardtii*. Three female forms may be distinguished. (1) Similar to ♀ f. *noctula*, but the white markings are more pronounced on the upperside. (2) Upperside : ground-colour and fore-wing subapical band of spots white. (3) Upperside : ground-colour and fore-wing subapical band of spots greenish-yellow.

The male and the second female form are figured in Seitz (*loc. cit.*).

Sumbawa; Flores; Adonara; Alor; Timor.

Ixias paluensis Martin.

Ixias paluensis Martin, 1914, *Deuts. Ent. Z. Iris* **28** : 68. ♂♀, Paloe, Celebes.
Ixias paluensis Martin, 1920, *Deuts. Ent. Z. Iris* **34** : 185. ♂♀, Paloe, Celebes.

♂. Upperside : fore-wing; base of wing and basal half of cell bluish-grey; apical two-thirds of wing and apical half of the cell dark-brown; a small brownish-orange marking at the apex of the cell; a row of five elongated white spots in the interspaces beyond the apex of the cell; a submarginal band of elongated white markings in the interspaces 1a and 1b. Hind-wing; base of wing bluish-grey; disc of wing white; a dark-brown marginal band 9 mm. in width. Underside : both wings yellow; a small brownish-black spot at the middle discocellular; a brownish-black marking at the tornus of the fore-wing. ♀. Upperside : fore-wing dark-brown; a row of four elongated white markings in the interspaces beyond the cell; a submarginal row of five indistinct white spots; a white marking at the lower margin of the wing 5 mm. long extending into interspace 1b. Hind-wing; basal half white dusted with dark-brown scales; outer half of wing dark-brown. Underside : both wings brownish-yellow with numerous dark-brown minute spots and lines; a submarginal row of dark-brown spots; a small dark-brown spot at the middle discocellular; a large dark-brown marking at the tornus of the fore-wing. Expanse of wings ♂ and ♀ 60–65 mm.

The early stages are fully described by Dr. L. Martin, 1912, *Deuts. Ent. Z. Iris* **26** : 191–196.

Paloe, Celebes.

Ixias vollenhovii Wallace.

Thestias vollenhovii Wallace, 1867, *Trans. ent. Soc. Lond.* (3) **4** : 393. ♂, Timor.
Thestias venatrix Wallace, 1867, *Trans. ent. Soc. Lond.* (3) **4** : 393. ♂ ("Moulmein") Timor.
Ixias venatrix (Wallace) Butler, 1871, *Proc. zool. Soc. Lond.* **1871** : 254, pl. 19, f. 1. ♂, Timor.
Ixias vollenhovii (Wallace) Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 160, pl. 72d. ♂, Timor.

The type specimen of *vollenhovii* is a male (expanse of wings 59 mm.) with strongly marked brownish-black bands on the upperside of the fore-wing; the ground-colour of the underside is yellow.

The type of *venatrix* is also a male (expanse of wings 50 mm.) with much

narrower brownish-black bands on the upperside of the fore-wing : the ground-colour of the underside is much paler than in *vollenhovii*.

Only one female form is known. This has the upperside ground-colour greenish-yellow and the fore-wing subapical band of spots reddish-orange. The differences between the wet- and dry-season forms are the same in both sexes.

Wet-season form *vollenhovii* Wallace; Dry-season form *venatrix* Wallace. The type specimens of both forms are in the British Museum.

Timor; Wetter; Roma; Letti; Moa; Kisser.

Ixias kühni Röber.

Ixias kühni Röber, 1891, *Tijd. Ent.* **34** : 287; fig. in vol. **35**, pl. 4, ff. 3, 4. ♂♀, Wetter.
Ixias kuehni (Röber) Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 160, pl. 72d, ♂; pl. 73a. ♀, Wetter.

Apparently a very local form which occurs only on Wetter Id. A single male specimen in the British Museum labelled Kisser (ex coll. Fruhstorfer) may be an error, as Fruhstorfer (*loc. cit.*) does not mention this locality.

Both sexes are figured in Seitz (*loc. cit.*), whose figure of the female shows a form with a more restricted fore-wing subapical band of spots than any in the British Museum collection.

Two female forms are known.

(1) Upperside ground-colour white; fore-wing subapical band reddish-orange. (2) Upperside ground-colour greenish-yellow; fore-wing subapical band reddish-orange.

Wetter Id. (Kisser ?).

Ixias flavipennis Grose-Smith.

Ixias flavipennis Grose-Smith, 1885, Forbes, *Nat. Wanderings Sumatra* : 275. ♂, Mt. Dempo, Sumatra, 4000 ft.
Ixias pyritis Weymer, 1887, *Stettin. ent. Ztg.* **48** : 13 pl. 1, f. 4. ♂, Padang, W. Sumatra.
Ixias flavipennis (Grose-Smith) Fruhstorfer, 1910, Seitz, *Gross-Schmett. Erde* **9** : 159, pl. 72b ♂, 72d. ♀, Sumatra.

A very distinct species which appears to occur only at higher elevations. The sexes are strikingly different, the male having both wings golden-yellow on the upperside with black margins, while the female has both wings white with brownish-black marginal borders.

Both sexes are figured by Seitz (*loc. cit.*).

pyritis Weymer (*loc. cit.*) appears to be a synonym.

The type specimen of *flavipennis* is in the British Museum.

W. Sumatra : Sinabong, Padang, Proepoe, Korintji Valley; N.E. Sumatra : Deli.

A NEW GENUS AND TWO NEW SPECIES OF GERRIDAE, SUBFAMILY HALOBATINAE (HEMIPTERA HETEROPTERA) FROM TRINIDAD

By W. E. China, M.A., F.R.E.S.

Dr. Noel Hynes has recently submitted to me for identification a collection of water bugs from Trinidad. The Gerridae are represented by *Cylindrostethus palmaris* Drake & Harris, *Limnogonus hyalinus* F., *L. guerini* Leth. & Serv., *Trepobates comitialis* Drake & Harris, *Metrobates spissus* Drake & Harris, *Brachymetra albinervis* A. & S., *Rheumatobates imitator* Uhler, and two new species representing a new genus which I describe herewith. My thanks are due to Dr. Hynes for enabling me to study these insects. He has collected a considerable amount of ecological data on the aquatic Hemiptera of Trinidad and proposes at some future date to publish an account thereof, so that although I have some of his notes by me, I have refrained from publishing more than the bare facts of locality and habitat.

Hynesia gen. n.[1]

Small Halobatinids allied to *Rheumatobates* but rather larger and more robust, with longer antennae, the hind legs of the male simple, not modified, but the front legs abnormal and strongly modified. Winged form unknown.

Head triangular, distinctly shorter (about two-thirds) than broad across the eyes, the latter strongly prominent laterally and extending posteriorly a little beyond the anterior margin of the pronotum, about one and a half times longer than greatest width, inner margins straight and parallel; vertex convex, rather more than twice as wide as an eye; the rather acute tylus projecting forward between the bases of the antennae; rostrum robust, extending slightly beyond the anterior coxae, on to the mesosternum, first and second segments short, third longest; antennae about as long as from apex of head to base of metanotum, with the second and third segments shortest, more or less subequal, second segment in male armed with a spine; basal segment in male more or less modified, armed with two spines. Pronotum truncate anteriorly: in middle less than one-fourth the length of mesonotum, but widening laterally into two backwardly produced, more or less apically angular lobes which are twice as long as pronotum in middle. Mesonotum convex, parallel-sided in male (the lateral margins broadly convex) with a percurrent median longitudinal suture or shallow furrow. Posterior margin of mesosternum deeply emarginate. Middle coxae strongly incrassate, more than twice as wide as hind coxae; front trochanters incrassate and more or less keeled beneath; front femora of male incrassate, the posterior margin armed with a row of strong spines, the anterior edge of ventral surface with a characteristic tuft of stout spines. Middle and hind legs normal, the middle femora and tibiae of male fringed with long hairs, all tarsi two-segmented. Genital segments of male as well as of female very elongate. Genitalia similar in plan to those of *Rheumatobates* Berg. but differing in the presence of a distinct bridge-like structure surrounding dorsal shaft of vesica (see figs. 4 d, and 5 d).

Genotype :—*Hynesia trinitatis* sp. n.

Allied to *Rheumatobates* Bergroth, which it resembles in the curiously modified male antennae. It differs, however, in the much broader, more transverse

[1] The genus *Telmatobates* Berg. 1899 is unknown to me and the description not now available.

head, much shorter laterally between apex of eye and base of antenna, in the broader and more rounded eyes, in the much shorter pronotum and longer mesonotum, in the strongly incrassate and spined front femora of male, in the simple non-modified hind legs of male, and in the elongate male genital segments. The male antennae are much less modified than in *Rheumatobates*.

This genus is dedicated to the collector Dr. Noel Hynes.

Hynesia trinitatis sp. n. (figs. 1, 2 a, and 4).

Colour:—♂. Dull brownish-black with ochreous yellow markings. Head ochreous yellow, with a large diamond-shaped dull black spot on disc, one angle extending to the

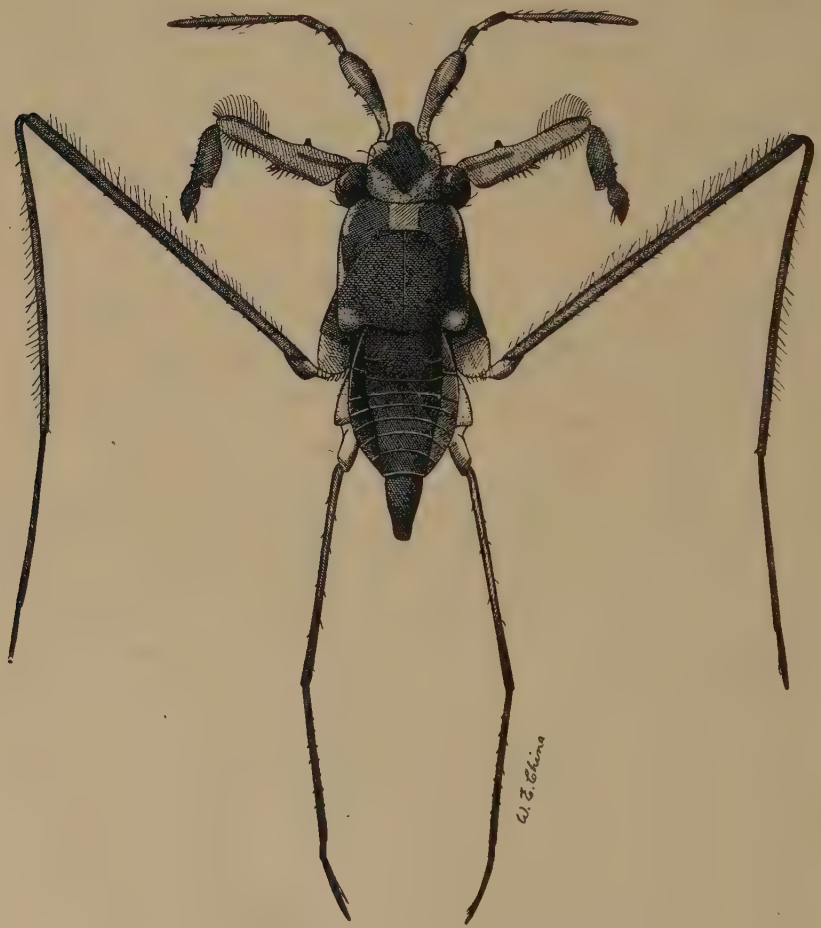

FIG. 1.—*Hynesia trinitatis* gen. et sp. n. ♂.

apex of tylus, the opposite angle to near middle of base of vertex, the other two angles extending nearly to lateral margins of head at level of apical margin of eyes, basal lateral angles of vertex dull black; underside pale yellow; eyes shining dark brown, rostrum dark brown, black at tip; antennae with basal segment pale yellow at base and beneath, shining brown above, second and third segments dark brown on apical half and sordid ochreous on

basal half, fourth segment entirely dark brown. Pronotum dull black with a quadrangular ochreous yellow spot in middle of narrow central region; propleura and prosternum yellow. Mesonotum dull black with an ochreous spot at each posterior lateral angle; mesopleura dull black, each with a large oval ochreous spot; mesosternum pale yellow with the anterior region broadly, and the posterior margin more narrowly brown. Metapleura dull black, mesosternum brown. Coxae and trochanters pale yellowish beneath, ochreous above, the middle coxa above with a large brown patch towards base, the middle trochanter largely brown on its outer face and the hind trochanter brownish inwards and towards apex; anterior femur yellow with two broad longitudinal stripes, the spines and bristles black; anterior tibia and tarsus brown to black, the former with its underside sordid ochreous and a longitudinal ochreous stripe on its upperside. Middle femur dark brown with two long ochreous stripes extending along the basal three-quarters above and below, hairs black;

FIG. 2.—a. *Hynesia trinitatis* gen. et sp. n. ♀. b. *Hynesia trinitatis* gen. et sp. n. ♀. (Middle and hind legs omitted.)

middle tibia and tarsus dark brown or black, long hairs on former black; hind femur, tibia and tarsus with similar coloration to those of the middle leg. Abdomen dull black, the extreme edge of connexivum and the apical half of seventh tergite obscurely dark fulvous; venter brown, rather paler down middle, the apical half of the seventh sternite and the eighth pale ochreous.

♀. Similar to male but second antennal segment entirely black, mesonotum with a longitudinal yellow stripe down middle, narrow anteriorly and widening posteriorly to posterior margin. Middle coxae entirely yellow, the edge of the connexivum distinctly yellow, this yellow stripe broadening on to apical tergite. Apical half of bulbous eighth abdominal tergite yellowish, this pale area extending anteriorly in middle. Anterior femur yellow with a percurrent brown stripe along posterior margin and another brown stripe along apical third of anterior margin.

Structure :—♂. Head about two-thirds as long as wide across eyes (40 : 64); vertex between eyes more than twice as wide as one eye (34 : 15), eye only one and a half times

as long as greatest width seen from above (22 : 15), straight lateral margin of head between apex of eye and base of antennal tubercle less than half the length of eye (9 : 22); head above covered with short pubescence, longer towards anterior and basal lateral angles, with four rather indistinct pits, the basal pair in line with apices of eyes, the anterior pair much closer together and placed half-way between basal pair and base of clypeus (tylus), each pit with a long depressed bristle arising therefrom, a similar pair of sensory bristles posteriorly one in each posterior lateral angle of vertex; some long bristles arising from outer margin of vertex along margin of eye and a pair of similar bristles, one on each side between apex of eye and base of clypeus; posterior region of eye with 2 bristles. Relative length of rostral

Fig. 3.—*Hynesia mangrovensis* gen. et sp. n. ♂.

segments (12 : 3 : 25 : 13); relative lengths of antennal segments 47 : 16 : 14 : 61; the basal segment incrassate except at extreme base and strongly curved, the convex face uppermost, the concave face downwards, the swollen region covered with moderately long suberect pubescence, the outer edge armed with two subequal robust black spines placed on the apical third of segment, the underside of segment with a dense, oblique row of long hairs extending from inner edge near base to the middle of the outer edge, where the hairs thicken to become more or less slender spines; inner edge with a line of long hairs becoming much denser and broader towards the apex and forming an elongate tuft of hairs; second segment one-third length of first, not incrassate, armed at middle of outer side with a stout black spine and between this and base of segment with a pair of slender obliquely backwardly

directed bristles; third segment shorter and slightly thicker than the second; fourth segment nearly four times as long as second, linear, moderately curved and inserted just below the apex of the third segment on its outer side, provided with a row of long hairs down outer side in addition to the normal short pubescence.

Pronotum covered with dense very short depressed pubescence, much sparser in middle, the lateral lobes nearly three times as long as pronotum at middle line and rather acutely angular at apices. Mesonotum nearly five times longer than pronotum in middle (50 : 11),

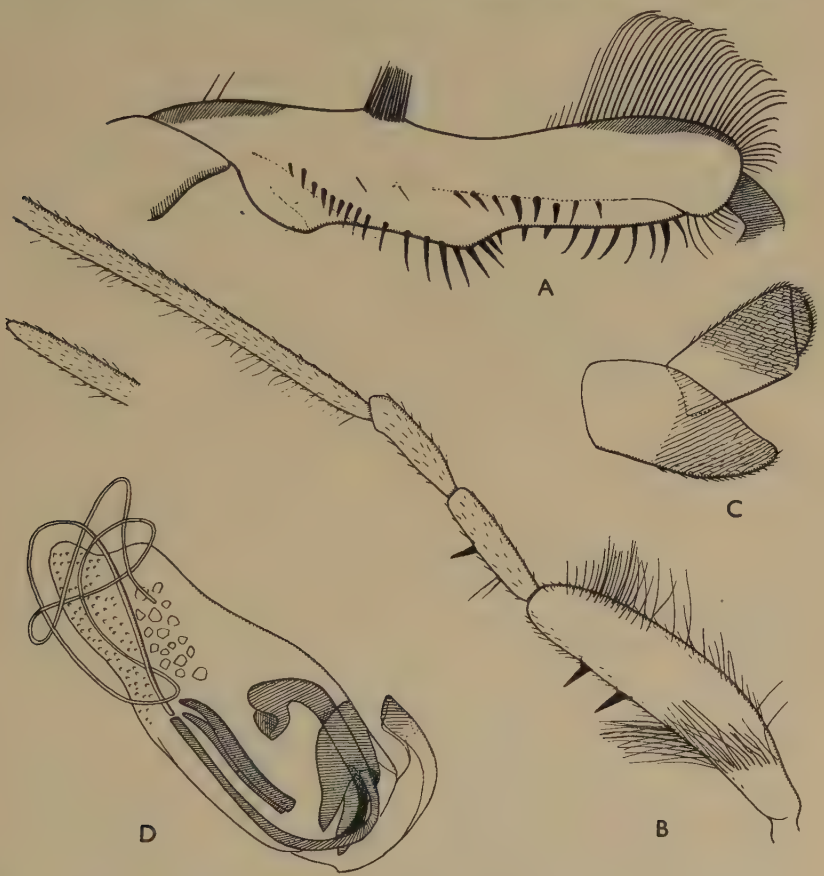

FIG. 4.—*Hynesia trinitatis* gen. et sp. n. a. Front femur (posterior-ventral view). b. Antenna (ventral view). c. Pygophor and anal tube (ninth and tenth abdominal segments). d. Aedeagus (right-hand view).

distinctly wider than long (66 : 50), parallel-sided, covered with very short depressed pubescence except down median suture. Front coxa small, cylindrical; front trochanter swollen, laterally compressed and more or less keeled ventrally, its outer surface shortly pubescent; front femur (fig. 4 a) somewhat incrassate, the basal half more or less compressed dorso-ventrally, the apical half compressed laterally so that the whole femur has a twisted appearance; basal fourth beneath with a deep oblique groove into which the keeled trochanter may fit when the femur is bent posteriorly, the anterior edge of this groove lined with a correspondingly oblique row of stout black spines, short, closely set and posteriorly hooked towards the base of the row and long, straight, and more widely separated towards apex

of row, which extends to the middle of posterior ventral edge of femur; thence another row of spines along the posterior ventral edge, short and robust at first, gradually increasing in length and becoming more slender and curved, extending to apex of femur. In the middle of the ventral surface of femur there is a short row of eight short spines parallel with and fairly close to the posterior ventral margin; on the anterior ventral side of the femur, about two-thirds its length from the apex, is a swelling surmounted by a bunch of closely packed and partly fused spines, while on the apical third of the anterior edge is a dense fringe of very long hairs curved towards the apex of the femur. Front tibia broad and rather swollen, dorso-ventrally compressed, armed with a single spiniform tooth on its anterior (outer) side towards the apex, with the apex produced in a lobe on the posterior side, this lobe fringed with a row of scale-like spines projecting in line with axis of tibia. Front tarsus very broad, two-segmented, the basal segment very small, claws long, inserted in middle of inner face of second segment. Middle legs with coxa strongly swollen, trochanter small, femur linear, armed with two rows of widely separated short black bristles on underside and a dorsal fringe of long hairs; middle tibia and tarsus linear, the former with a dorsal fringe of long hairs and a few ventral short bristles, tarsus two-segmented, claws very short. Hind coxa small, little wider than trochanter, femur, tibia and tarsus linear, the femur and base of tibia armed with a few scattered short black bristles, the tarsus two-segmented, the claws long and slender, arising from near the base of second segment.

Relative lengths of legs :—

	Coxa	Trochanter	Femur	Tibia	Tarsus 1	Tarsus 2
Front . .	5	7	24	11	1·5	6
Middle . .	9	6	62	55	30	10
Hind . .	8	7	34	26	2	12

23·5 = 1 mm.

Abdomen extending about half its length beyond the apices of hind coxae. Eighth and genital segments forming an elongate process which is nearly three times longer than wide at widest part of eighth segment (28 : 15). Genitalia figured (fig. 4 c and d). Lateral plates (Schroeder's 1931 terminology) linear, acuminate posteriorly, truncate anteriorly. Bridge-like sclerite surrounding dorsal shaft of vesica, relatively broad.

Total length, 3·1 mm. Width across middle of mesonotum 1·0 mm.

Structure :—♀. Longer and broader than male, head as in male but without four sensory pits; rostrum as in male; antennae simple, linear, the basal and second segments not incrassate and without spines or long hairs; the third segment with two or three long black bristles near apex; sometimes one on second segment (Madame Espagnole ♀); relative lengths of segments 30 : 13 : 19 : 42; the first and fourth segments distinctly curved. Mesonotum much wider posteriorly than anteriorly, the sides anteriorly convergent, not parallel as in male, with several long bristles and hairs. Front femur relatively slender, linear, posterior side with a fringe of long hairs and a row of very small setigerous teeth; front tibia and tarsus much less thickened than in male, the posterior side of tibia with several long black bristles. Relative lengths of legs :—

	Coxa	Trochanter	Femur	Tibia	Tarsus 1	Tarsus 2
Front . .	6	8	22	11	1·5	7·5
Middle . .	9	6	59	50	29	10
Hind . .	7	6	38	23	3	11

23·5 = 1 mm.

Abdomen extending much more than half its length beyond the apices of hind coxae; eighth segment bulbous, narrowed suddenly towards apex; ninth segment elongate, parallel-sided.

Total length, 3·7 mm. Width across base of mesonotum 1·2 mm.

Habitat :—British West Indies, Trinidad; Caroni Swamp, under mangrove, 6 ♂♂ (including type), 17 ♀♀, and 1 nymph, 21.i.1942 (N. Hynes); Madame Espagnole, River Trinidad, under mangrove, 1 ♂, 1 ♀ and 1 nymph, 21.i.1942 (N. Hynes, coll. no. 149). Species " L " in Hynes' notes.

Fig. 5.—*Hynesia mangrovensis* gen. et sp. n. ♂. a. Front femur (posterior-ventral view). b. Antenna (ventral view). c. Pygophor and anal tube with aedeagus *in situ* (ninth and tenth abdominal segments). d. Aedeagus (right-hand view).

Hynesia mangrovensis sp. n. (figs. 2 b, 3 and 5).

Colour :—♂. Dull brownish-black with ochreous yellow markings; head black above and pale brown beneath, the basal half of vertex fulvous except in middle, where the dark colouring of the front half of head extends downwards in middle in the form of a right angle which does not reach basal margin of vertex; eyes shining dark brown; rostrum dark brown, black at base and tip; antennae black except base of first segment, which is sordid pale yellow. Pronotum dull black with a wide pale yellow quadrangular spot in middle,

nearly twice as wide as that in *H. trinitatis*, and covering the whole of the central narrow region of pronotum; propleura (behind eyes) and prosternum yellow. Mesonotum dull black with the posterior lateral angles fulvous and a rather obscure fulvous stripe down the middle; mesopleura dull black, each with a large oval ochreous spot covering nearly the whole of the anterior half and extending dorsally to edge of mesonotum; mesosternum yellow, the anterior margin and a large semicircular area at middle of each side dark brown. Metapleura dull black, metasternum dull black with an obscure fulvous spot in the middle. Coxae and trochanters yellowish, the apical halves of middle and hind trochanters brown, the front femur yellowish shading to brown apically, the apical third dark brown, spines black; anterior tibiae and tarsi black; middle and hind femora, tibiae and tarsi dark brown to black with an obscure fulvous mark at base of upperside of each femur. Abdomen dull black, the eighth tergite largely fulvous. Venter dark brown, the seventh sternite rather lighter, the eighth sternite ochreous yellow and the genital segments dark brown.

♀. Similar to male but with basal segment of antenna yellow except for apical third; which is infuscate; the yellow quadrangular spot in middle of pronotum much wider and extending slightly posteriorly on to the lateral lobes of pronotum; longitudinal yellow stripe down middle of mesonotum very much broader; anterior femur yellow except for apical fourth, which is dark brown; basal half of anterior tibia sometimes obscurely fulvous, extreme base of middle femur obscurely fulvous, basal fourth of hind femur pale yellow. The edge of apical half of connexivum obscurely ochreous, the yellowish stripe broadening on to the apical tergite. The bulbous eighth abdominal tergite with a broad, pale yellow, percurrent stripe down middle. Mesosternum and venter largely fulvous yellow with base of former and sides of latter dark brown; eighth sternite ochreous yellow; genital segments black.

Structure :—♂. Head rather more than half as long as wide across eyes (35 : 62); vertex between eyes about two and a half times the width of one eye (35 : 13); eye rather more than one and a half times as long as greatest width seen from above (22 : 13); head above covered with short pubescence, longer anteriorly, the four setigerous pustules present as in *H. trinitatis* but not sunk in shallow pits or very obscurely so; a similar pair of sensory bristles placed posteriorly one in each basal lateral angle of vertex, three or four long bristles down each side of vertex along inner margin of eye and one on each side of head between apical margin of eye and insertion of antenna, posterior area of eye with two long bristles; relative length of rostral segments 9 : 3 : 23 : 12; relative length of antennal segments 50 : 16 : 14 : 24; the basal segment (fig. 5 b) only slightly thickened in basal two-thirds, sinuate, thickest in middle, armed on outer side with two stout spines arising from short protuberances, the larger placed just below middle of segment, the smaller placed half-way between the median spine and the apex of segment; second segment very slightly thickened, armed on outer side with a stout spine placed in middle; no long hairs or bristles on antennae as in *H. trinitatis* except on third segment, the fourth segment relatively much shorter than in *H. trinitatis* but similarly curved.

Pronotum with very short depressed pubescence, very sparse in middle, thicker and longer towards sides, the lateral lobes about two and a quarter times as long as pronotum in middle (24 : 10). Mesonotum rather more than five times as long as pronotum in middle (54 : 10), distinctly wider at base than long (68 : 54), slightly wider at base than anteriorly, covered with a very short depressed pubescence except down middle line and some long hairs and bristles down lateral margins. Front coxae short, semi-spherical; front trochanter somewhat swollen, lightly compressed laterally and rounded beneath, not keeled; front femur (fig. 5 a) distinctly incrassate, narrowing to apex, dorsal surface (upperside) in middle somewhat compressed above posterior edge, basal fourth of posterior side with a short shallow groove bounded at base on upperside by a distinct lobe or prominence; apical half of posterior (inner) side with a close-set row of strong black spines, longest in middle, beginning at apex of upper posterior edge and curving inwards (*i.e.*, downwards) to form at

the middle of the femur an arc of three or four longer spines directed upwards instead of backwards; lower edge of posterior side in middle with a much shorter, rather irregular row of black spines, of varying lengths extending basally to well beyond end of the upper row of spines; ventral surface with two close-set convergent stout spines near anterior edge, placed about two-thirds of length of femur from its base; also with a small short tuft of exceedingly close-set bristles, placed away from anterior edge, less than one-half of length of femur from base; apical third of anterior (outer) side with dense but rather short pubescence; front tibiae broad, scarcely swollen and laterally compressed, unarmed and without the tooth on the anterior side present in *H. trinitatis*; apex of tibia produced in a lobe on the posterior side, this lobe fringed with row of scale-like spines projecting in line with axis of tibia; front tarsus as in *H. trinitatis*. Middle leg with coxa swollen, trochanter small, femur linear, armed along posterior side with a row of short stout bristles and a sparse fringe of long hairs, anterior side without the fringe of long hairs present in *H. trinitatis*; middle tibia and tarsus linear, the former in middle with an anterior fringe of long hairs as in *H. trinitatis* and with a few, widely separated, very short bristles along posterior side; hind coxae small, little wider than trochanters, femur, tibia and tarsus linear, the femur in middle of posterior surface with seven or eight long hairs, the tibiae with widely-separated short bristles along posterior side, the tarsus with basal segment relatively much longer and the apical segment much shorter than in *H. trinitatis*.

Relative lengths of segments :—

	Coxa	Trochanter	Femur	Tibia	Tarsus 1	Tarsus 2
Front . .	3·7	7·5	19	9	1	5
Middle . .	8	6	54	47·5	24	7·5
Hind . .	6	7	32	21	3	6

23·5 = 1 mm.

Abdomen extending about half its length beyond apices of hind coxae. Eighth and genital segments forming an elongate tube which is twice as long as eighth tergite at base (30 : 15). Genitalia figured (fig. 5 c and d), very similar indeed to those of *H. trinitatis*. Differing only in greater length of filiform vesica and in shape of the bridge surrounding dorsal shaft of base of vesica, which is much narrower.

Total length :—2·8 mm., width across middle of mesonotum 0·9 mm.

Structure :—♀. Larger and broader than ♂, antennae simple, linear, basal and second segments unarmed with spines, but with the second segment with a long dorsal bristle and third segment with some long bristles on dorsal surface. Relative length of segments 31 : 13 : 17 : 25, the fourth segment relatively much shorter than in *H. trinitatis*. Pronotum with narrow median region much wider than in male. Mesonotum much wider posteriorly than anteriorly, the sides strongly anteriorly convergent with several long bristles and hairs. Front femur relatively slender and linear, posterior side with a fringe of long hairs, but without the row of minute setigerous teeth present in the female of *H. trinitatis*; front tibia and tarsus much less thickened than in male, the posterior side of tibia with several long black bristles. Relative lengths of legs :—

	Coxa	Trochanter	Femur	Tibia	Tarsus 1	Tarsus 2
Front . .	3	6	20	10	1	8
Middle . .	8	7	52	45	23	9
Hind . .	6	5	34	20	4	6

Abdomen extending much more than half its length beyond the apices of the hind coxa; eighth segment bulbous, narrowed suddenly towards the apex, shorter than genital segment (26 : 30); the latter elongate and parallel-sided.

Total length :—3·3 mm. Width across base of mesonotum 1·1 mm.

Habitat :—British West Indies, Trinidad; Yarra River, 28 ♂♂, 27 ♀♀, and 2 nymphs, 17.v.1942 (N. Hynes, coll. no. 173); Yarra River, Blanchisseuse, 1 ♂, 7 ♀♀, 27.xii.1941 (N. Hynes, coll. no. 142). Species " K " in Hynes' notes.

Apart from the very differently shaped and armed antennae and front femora in the male, this species can be readily distinguished in both sexes from *H. trinitatis* by the black instead of yellow anterior lateral region of the head in front of the eyes; by the much wider, more transverse yellow spot in middle of pronotum; by the presence of a narrow longitudinal fulvous stripe down middle of mesonotum in male and by the much broader mesonotal stripe in the female. The yellow stripe down the middle of eighth abdominal tergite in female is much broader than in *H. trinitatis*.

In spite of the very distinct differences in colour and structure, the genitalia of these two species are extraordinarily similar, and do not show the distinctive specific differences found in *Rheumatobates,* which genus *Hynesia* strongly resembles.

NEW ORIENTAL ODONATE LARVAE

By Lt.-Col. F. C. Fraser, I.M.S. Retd., F.R.E.S.

For many years now I have had in my collection a number of Odonate larvae which have remained undescribed. It is one of my regrets that during thirty years spent in the Orient, I did not, or rather could not, find time to study the larvae of Oriental Odonata as closely as I would have wished. What time could be spared by a hard-worked surgeon, especially in the later years, was almost entirely given to the collecting of imagines. The collecting of new species of the imago will always be more attractive than the discovery of new larvae, especially as it is often difficult to determine to which species the latter belong. During my sojourn in India; Ceylon and Burma, I was able to add knowledge of some 200 new species and subspecies of Odonata to science, and almost double that number to the Indian fauna. The late Dr. F. Ris, amazed at the wealth of my discoveries, wrote, " Sir, you have discovered a new world ! " A great number of discoveries remain, however, to be made in this new world, and this applies particularly to the Odonate larvae, a task which will fall largely to Indian students of the future. Nevertheless I have been able to collect a number of notes and sketches of these larvae from time to time, which has now amounted to the proportions of a small volume; much material was added by that indefatigable collector Mr. T. Bainbrigge Fletcher, to whom all students of Oriental Entomology are greatly indebted. The sketches illustrating this paper were made by myself some years ago, and on reviewing them, I have not found it necessary to make many alterations. Those of *Merogomphus longistigma* (Fraser) and *Caliphaea confusa* Selys are of great interest, the latter exceptionally so as this insect has been for long one of the enigmas to worry the systematist : a knowledge of its larva now shows clearly that it is derived from the same root as *Mnais*.

I take this opportunity of correcting an unfortunate error to which Dr. Wheeler has called my attention. In my paper on his collection of Odonata made in the Federated Malay States (*Proc. R. ent. Soc. Lond.* (B) (7) **11**) I gave Dr. Wheeler's name as " Raymond "; it should be " L. Richmond."

Order Odonata.

Family Platystictidae.

Protosticta mortoni Fraser (fig. 1).

Head roughly triangular, rounded in front : eyes projecting but moderately laterally; ocelli distinct; antennae of moderate length, filiform, 7-segmented. Labium, when at rest, extending to posterior border of prothorax, elongately oval, median lobe flat, produced apically and deeply fissured, the sides of this fissure slightly overlapping, bordered with scale-like, quadrilateral setiform teeth. Lateral lobes Gomphine-shaped, bearing a long movable hook and ending in a robust inwardly curved tooth. Setae absent throughout but the mental plate striated and minutely pitted. Prothorax robust, rounded outwardly, presenting two large dorsal bosses. Thorax longer than wide, traversed by two rather deep corrugations or sulci. Wing-pads subcylindrical, narrow, extending to the apical border of segment 4 of the abdomen, held closely parallel. Legs long, slender, coarsely but sparsely

pilose, furnished with rows of variably sized setae or bristles as shown in fig. 1. Tarsi 3-segmented, claws simple. Abdomen cylindrical but flattened beneath, tapering gradually to the end. Each segment bordered apically by a row of fine spines. Caudal gills 3 in

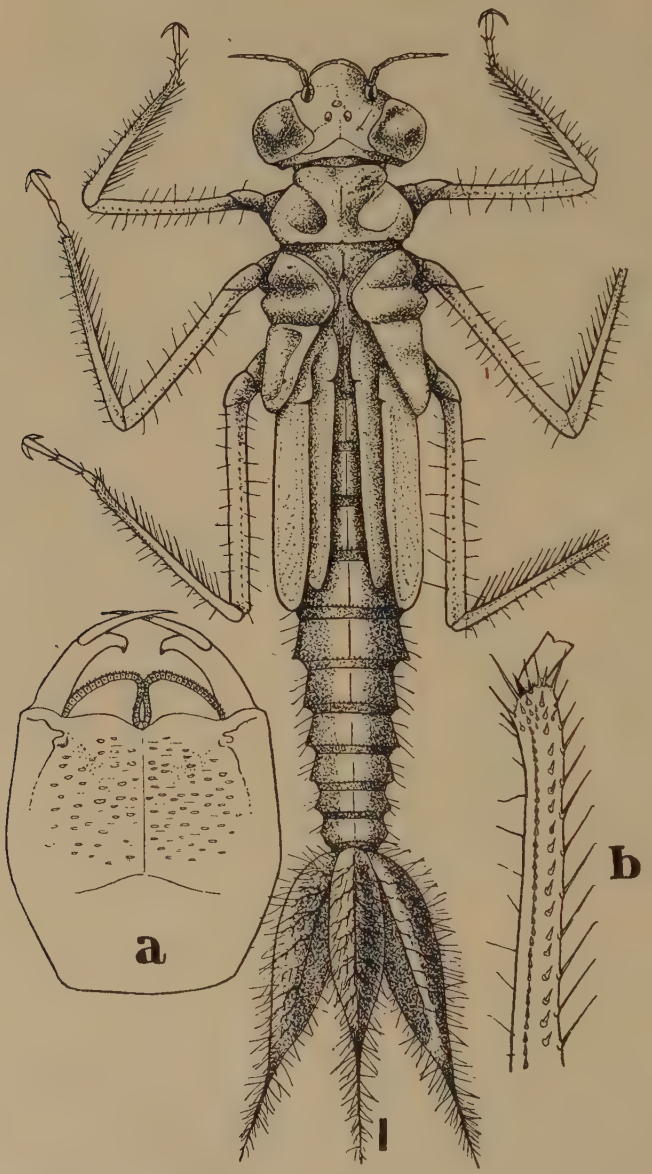

Fig. 1.—Larva of *Protosticta mortoni* Fraser. a. Labial mask. b. Distal portion of anterior tibia.

number, saccoid in character, the apposed surfaces flattened, the apices tapering to a filiform spine, the whole coarsely pilose and, in the natural state, coated with diatomaceous material. General colour of larva pale green without markings.

Habitat. Coorg, S. India. I found this species locally plentiful in a small mountain stream crossing the Sampaji Ghat road. The larvae were plentiful in the mossy scum-like coating of rocks in this stream, and exuviae could be

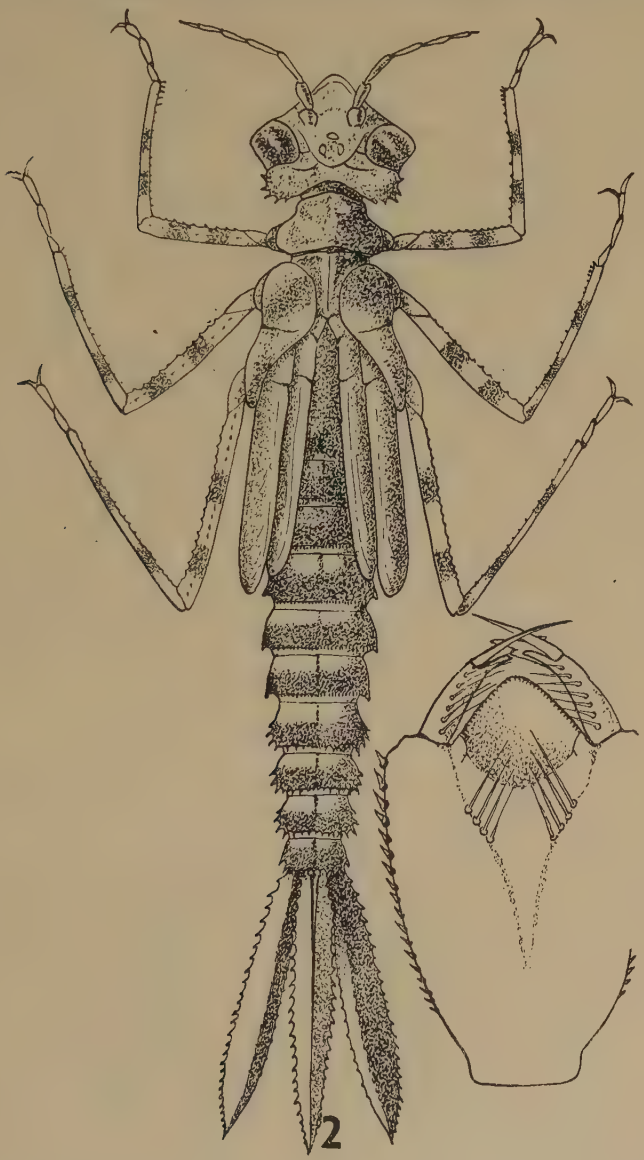

Fig. 2.—Larva of *Disparoneura apicalis* (Fraser). Labial mask inset.

found clinging to the sides of boulders lying in the bed of the stream. The larvae hug the surface of the rock closely and slither eel-like on this surface when disturbed.

Family Protoneuridae.

Disparoneura apicalis (Fraser) (fig. 2).

Head rather pentagonal in shape, produced anteriorly, eyes angulate outwardly, behind which the postero-lateral borders of head are globular and bear 5 large spines; ocelli clearly visible; antennae 7-segmented, filiform, the 3rd segment the longest. Labial mask elongate, pyriformate and narrowing posteriorly: mid-lobe produced cone-like, this portion being deeply cupped and bordered by closely-set minute blunt teeth. Lateral lobes narrow, tapering, furnished with a long movable hook and, at the end, a short obtuse tooth. Setae present on both lobes, 2 sets of 4 on the middle lobe and a row of 7 on the lateral. Laterally the mask is bordered with closely-set short robust spines. Prothorax relatively small, constricted anteriorly, somewhat produced laterally and with two coarsely sculptured tubercles on the anterior dorsum. Thorax elongate, shallowly but broadly grooved transversely between the meta- and meso-thorax. Wing-pads flattened, narrowly elongate, closely parallel, extending to the middle of abdominal segment 4. Abdomen cylindrical but tapering apically; segments 4–6 with a robust lateral spine apically, the remaining segments coarsely spined laterally and all finely spined along the apical border. Caudal gills highly chitinised, triquetral in section, narrowly elongate and acutely pointed at apices; borders lined with moderately robust imbricated spines. Legs long and spidery: femora and tibiae with 2 rows of very short, widely-spaced spines; claws simple. The body colour is greenish with darker olivaceous markings on the apical halves of the abdominal segments, and dark annulations, two in number, on all femora and tibiae.

Habitat. Near Dubary, Cauvery R., Coorg. A large colony exists here, extending less than a quarter of a mile along the river's banks; the species never having been found elsewhere. Larvae are found clinging to debris and submerged roots alongside the steep banks of the river or in still pools in the broken river-bed.

Caconeura gomphoides (Rambur) (fig. 3).

Head transversely rectangular, anteriorly very broadly rounded: eyes small, rounded, projecting but slightly from the antero-lateral angles of the head; antennae filiform, 2nd segment short and robust, 3rd and 4th longer and more slim, all segments tipped with a pale annule. Whole of head dark olivaceous brown with paler markings bordering the eyes, encircling the well-defined ocelli and variegating the vertex and occiput. A row of spines bordering the postero-lateral aspect of the head. Prothorax small, rounded, coarsely sculptured on dorsum and variegated with pale markings on a dark olivaceous background. Thorax short and broad, coloured as for prothorax. Wing-pads flattened, closely-apposed, extending on to segment 3. Legs long and spidery, pale greenish with two strongly defined dark annules on each femur and tibia. Femora with a row of 6 or 7 longish robust spines: tibiae with a row of minute coral-like spines, more closely-set distally. Abdomen cylindrical, tapering gradually to the end, bordered laterally and apically with short teeth-like spines, dark olive green with a well-defined pattern of oblique stripes as inverted V's on mid-dorsum, and a single oblique stripe to the outer sides of these. Caudal gills 3 in number, lamellate with a well-defined node at junction of middle and distal thirds, which latter is abruptly expanded as a broad ovate fin: outer border of basal two-thirds finely spined: tracheae coming off from a central trunk obliquely. A broad band of dark pigment traverses the middle portion of gills.

Labial mask kite-shaped, tapering basally, somewhat hollowed out anteriorly, extending as far back as hinder end of prothorax. Mid lobe projecting but slightly anteriorly, this border and the apposed one of the lateral lobes lined with tiny crenate teeth. Lateral lobes

long and narrow, fissured slightly and narrowly at apex, the outer portion bordering this fissure shortly quadrate and hooked, the inner much longer and forming a robust black-tipped tooth: a very long movable hook springs from the apex of this lobe, which is

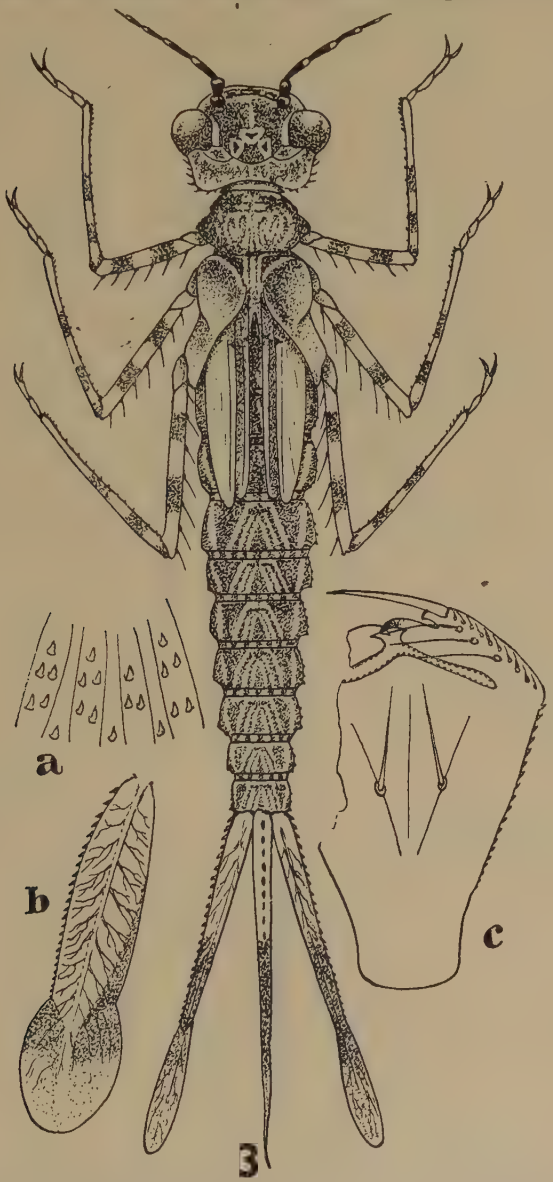

FIG. 3.—Larva of *Caconeura gomphoides* (Rambur). a. Teeth of gizzard. b. One of the caudal gills. c. Labial mask.

furnished along its outer border with 8 or 9 short setae and 3 very long ones to the inner side of these. The borders of the mentum are finely spined and there are two very long setae near the centre of the middle lobe. Gizzard with major and minor folds, the former with 3 to 5 teeth, the latter with single ones, all of the same size.

Habitat. This larva is found in the cold kundah streams of the Nilgiri Hills, S. India, generally in water-weed growing at the sides or bottoms of the deeper pools. It has adopted a temperate climate as opposed to all other

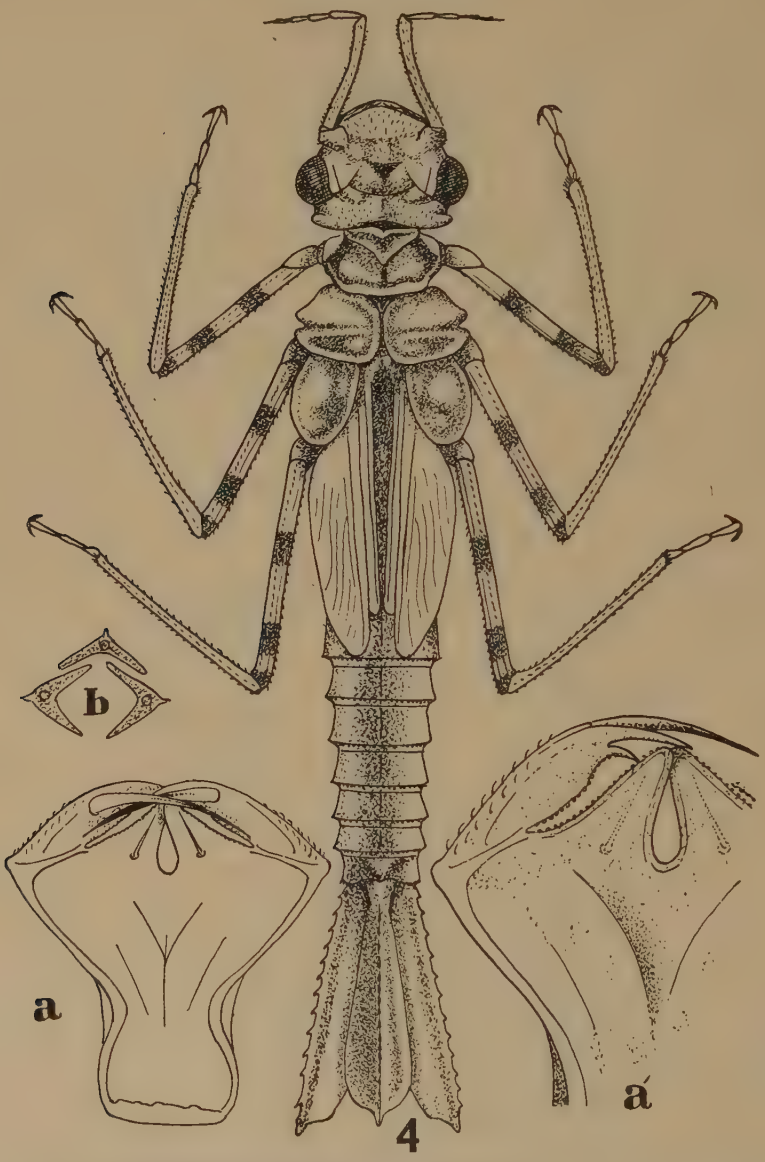

Fig. 4.—Larva of *Caliphaea confusa* Selys. a, a′. Labial mask. b. Transverse section of caudal gills.

species of the genus, and is not found below 7000 feet. Ice will be found, during the months of December and January, on pools bordering such streams as it inhabits.

Family Agriidae.

Caliphaea confusa Selys (fig. 4).

Head rather large, broadly arched in front, shallowly emarginate posteriorly with the postero-lateral angles raised into ridges and produced laterally as obtuse spines: ocelli obscure and lying in a deeply pigmented sunken triangular pit: eyes comparatively small, hemispherical, situated at sides of head and projecting but slightly; antennae 7-segmented, scape short and broad, pedicel strongly curved, as long as the remaining 5 distal segments which are much finer and shorter. Mask of labium kite-shaped, extending to bases of anterior coxae, middle lobe strongly constricted near its middle, its apical border strongly produced and very deeply fissured, the two long triangular lobes thus formed slightly overlapping one another at their apices and each furnished with a long robust seta at the middle of its base. The anterior border of this middle lobe and the apposed ones of the lateral lobes bordered with tiny rounded closely-set teeth. Lateral lobes robust, chelate, ending in two teeth, the inner short and curved, the outer double its length and nearly straight. A very long movable hook present. Two rows of stiff short bristles bordering the lateral lobes, scarcely amounting to the rank of setae. Prothorax broader than deep, raised dorsally into two smooth bosses, separated anteriorly by an excavated triangular plate. Thorax with irregular deeply notched outer border and ridged and furrowed transversely on dorsum. Wing pads large, parallel, extending to apical border of abdominal segment 4. Legs long and slim: femora quadrate in section, each border finely spined, marked strikingly with 3 dark annular bands, one at the middle of limb, one subapical and the third apical; tibiae with 3 rows of closely-set, fine spines. Tarsi 3-segmented, claws simple. Abdomen short, cylindrical, each segment finely spined along apical border, and the 10th with a robust dorsal spine. Caudal gills 3 in number, the dorsal one overlapping the lateral, all triquetral in section with a strong mid-rib which is margined with robust imbricated spines, and with lateral foliate expansions. Narrow at base, thereafter gradually expanding to become broadly obtuse at apices with the mid-rib projecting shortly as an apical spine. The middle or dorsal gill is slightly shorter than the lateral which are about as long as the final six abdominal segments taken together.

Habitat. Shillong, Assam and Ghoom, Darjeeling, Bengal. This larva inhabits sluggish irrigation channels or brooks flowing through marshes. Mr. T. Bainbrigge Fletcher's specimens, from which this description is taken, were found in a stream flowing through the Fruit Garden, Shillong, during April. The formation of the antennae and the shape of the labial mask are typical of the Agriidae, and the shape of the latter comes closest to that of *Mnais*.

Family Gomphidae.

Sieboldius nigricolor (Fraser) (fig. 5).

Length 22 mm.

I possess a single immature larva of a species of *Sieboldius*, which was found at Katkai, 4500 feet, N. Shan States, 18.xi.26. As it comes from the terra typica of *S. nigricolor* (Fraser), it is only fair to suppose that the larva belongs to this species, especially as this is the only known one from within Burmese limits. It resembles closely that described by Lieftinck for *S. japponicus* Selys (1932, *Bull. Raffles Mus.* **7**: 102, pl. 2, figs. 1 and 2a). Possibly the larva, when full grown, may resemble this species even more closely, but in its present instar it presents some differences from *S. japponicus* and *Sieboldius* sp. Needham.

The antennae have the penultimate segment narrower, longer and with an inner basal short spine; the apical segment is very minute (this is altogether lacking in Lieftinck's figure); the eyes are larger proportionately and more prominent. The abdomen at first widens and then narrows slightly towards the apical segments, instead of progressively widening to the 8th segment; lastly the latter segment has the outer border sinuous and distinctly produced as an obtuse lateral spine. The colour is as usual: a deep blackish-brown. The abdomen is greatly depressed and shallowly cupped beneath in a limpet-like manner. The antennae are flattened and form a bevelled ramp with the sloping frons; lastly the legs are greatly expanded and flattened. In short, the whole insect is clearly *stream-lined*.

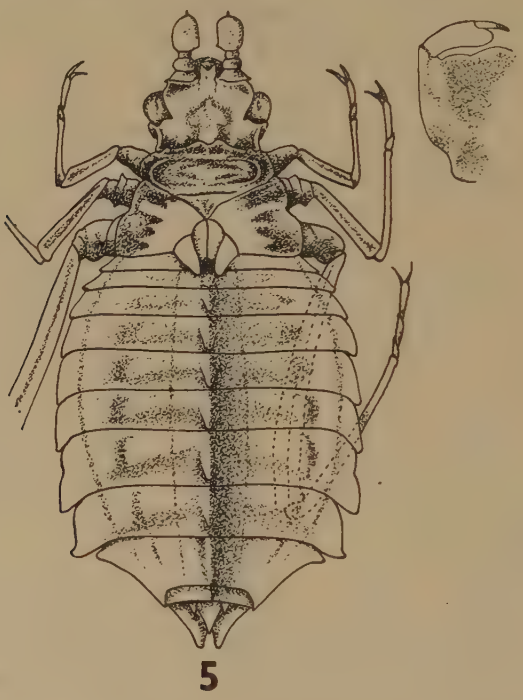

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Fig. 5.—Young larva of *Sieboldius nigricolor* (Fraser). Labial mask inset.

Habitat. Found amongst leafy trash in a deep pool in the course of a torrential stream. This agrees with the habitat of larvae of *Lamelligomphus*, which are also built similarly. The flattened, foliate-shaped body, together with the dark brownish-black colour, is typical of the rotting foliage which is found in the bottom of all such pools as these insects inhabit. Undoubtedly the colouring and, to a less extent, the shape, is purely protective and aids their concealment. So effective is this, that I found the only way to find *Lamelligomphus* larvae was to spread out the leafy trash in the hot tropical sun until conditions became so uncomfortable for the insects that they were compelled to crawl away, when, of course, they were at once conspicuous. Stream-lining, however, is also essential, for during the monsoon these mountain streams become raging torrents and the bottoms of even the deepest pools are scoured out. Faced with conditions such as this, only the limpet-shaped abdomen and a body designed to offer no resistance to the current could save them from being

swept away. I do not believe that *Sieboldius* would breed in adventitious waters such as Laidlaw describes. Such spots dry up almost as quickly as they form in the tropics and although I have often seen dragonflies ovipositing in

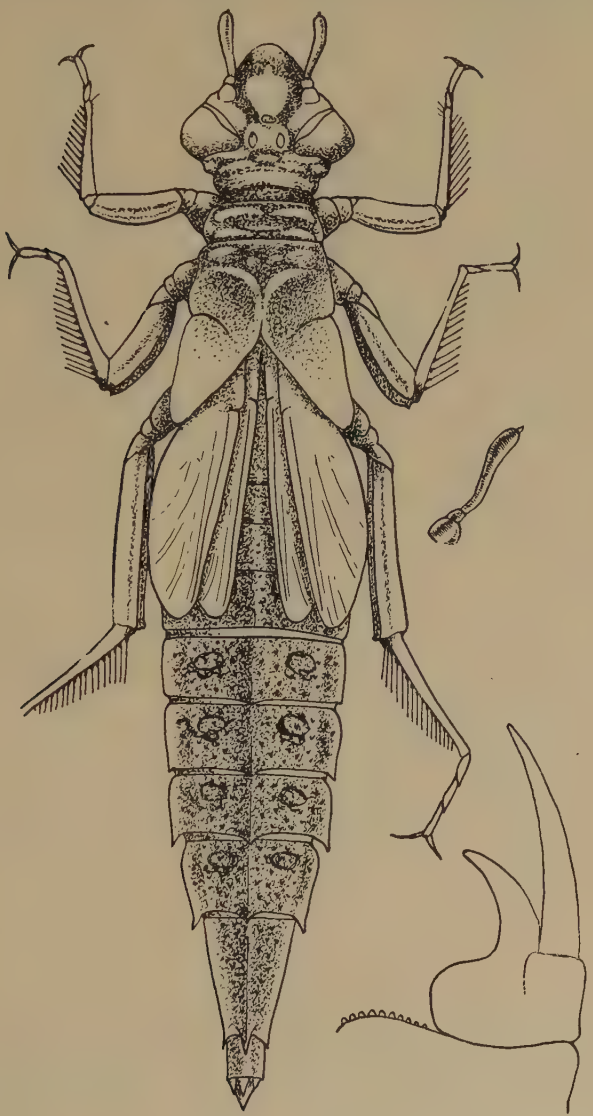

Fig. 6.—Larva of *Merogomphus longistigma* (Fraser). Antenna and Labial mask inset.

temporary rain pools, it was perfectly clear that nothing could ever result from the act. I may say that, on several occasions, I have seen Libellulines attempting to oviposit on the bonnet of my car, deceived by its glossy surface, and the reflection of the sun from it, into thinking it was water! On two occasions I

have noticed *Protosticta gravelyi* attempting to oviposit on the windscreen of my car, but no one would suggest from this that larvae might breed thereon. These frail dragonflies oviposit in the film of water flowing down the face of rocks and doubtless the sloping windscreen suggested a habitat of this nature.

Merogomphus longistigma (Fraser) (fig. 6).

Length of body 32 mm. Length of hind femur 7 mm.

Head triangular, produced squarely posteriorly; the eyes rounded and forming the outer angles of the head; antennae with short scape, conical in shape, a very much shorter pedicel, 3rd segment about six times longer than pedicel, apical segment a mere tiny spine. Labial mask of the conventional Gomphine shape, rectangular, flat: middle lobe with crenate border furnished with minute crenular teeth, lateral lobe very robust, with a long movable hook and a single sigmoidal tooth which has its inner border naked. Ocelli distinct; occiput with medial and lateral obtuse tubercles. Prothorax robust, two pairs of parallel ridges somewhat interrupted at the mid-dorsum; thorax with a third row of tubercles forming another parallel and broken ridge. Wing pads broad and long, almost parallel, extending nearly to apical border of segment 4. Abdomen cylindrical, broad at base and tapering thence to the end, which is prolonged in a pencil-shaped manner: segment 8 half as long again as 7, segment 9 greatly elongated and sharply tapered, twice as long as segment 7, segment 10 cylindrical, not more than one-third the length of segment 9, appendix dorsalis and cerci forming a minute conical end to abdomen. Legs short and very robust, femora strongly ridged and furnished with three longitudinal rows of minute spines, tibiae with long, closely-set bristles, shortening rapidly distally.

Habitat. Breeds in submontane streams and burrows deeply in the sandy bottoms, with all but the end of the abdomen buried. In this respect it resembles the larvae of *Macrogomphus*, and, I suspect, that of *Gomphus abdominalis* McLachlan, which is of the same shape. By their larvae, these three genera appear to be closely related but this is not borne out by generic characters, so that the larval similarity must be due to convergence; this coincidence is not surprising when one considers how useful the elongated end of the abdomen is in aiding the rectal gills to function whilst the body itself is almost entirely concealed. The original specimen from which this description was taken is in my collection and was taken whilst emerging on a rock in midstream at Kibribetta, N. Coorg, S. India, 4.v.24.

Anax immaculifrons Rambur (fig. 7).

Length of body 52 mm. Length of hind femur 11 mm.

General colouring olivaceous green with darker markings and mottling: the abdomen peppered with blackish spots, dorsal and lateral pairs of these being larger and particularly conspicuous. The intersegmental membranes coarsely striated; legs occasionally banded with dark olivaceous. Head flat, face and frons arched forward, transverse measurement considerably greater than antero-posterior. Eyes large, globular, bulging strongly from sides of head. Occiput broadly rectangular, its lateral angles tumid and rounded. Antennae filiform, scape short, cylindrical, pedicel of same length but less robust, remaining segments fine, the third the longer. Labial mask narrow and very elongate, tapering to mentum: middle lobe scarcely produced, cleft into two rounded or arched lobes, the free borders of which are fringed with short, closely-set setae: lateral lobe narrow, squared at the ends, the inner angle prolonged as a robust tooth, the inner border beset with short obtuse teeth: a long movable hook on the outer side markedly overlaps its fellow from the

opposite side. Prothorax and thorax irregularly cylindrical, rather short, the former strongly ridged posteriorly, the latter with wavy undulated dorsal plates. Legs rather long, robust, femora with flat surfaces separated by four finely spined ridges : tibiae with a few spines on the inner side : claws strong, simple. Wing pads closely applied to the sides, broad, nearly parallel. Abdomen narrow at base, gradually broadening to as far as the 8th segment, then slightly narrowing again to segment 10 : the appendix dorsalis and cerci

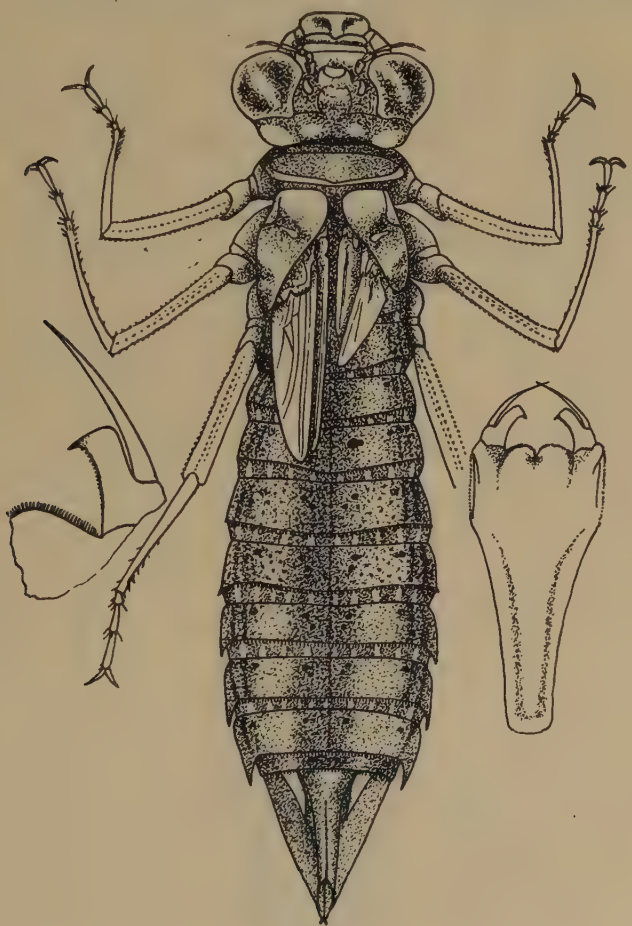

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Fig. 7.—Larva of *Anax immaculifrons* Rambur. The right side shows the undeveloped wing pads of an early instar : the left side the full adult stage. Inset labial mask and lateral lobe of same.

closely bunched together to form a stout conical protuberance at end of abdomen. Segments 7 to 10 with lateral spines, small and inconspicuous on 7, gradually enlarging to segment 10, particularly large on the last two segments : no dorsal spines. Each segment bordered posteriorly with a row of short setae.

Habitat. In ponds or sluggish streams with muddy bottoms. Although essentially palaearctic in its habitats, it breeds occasionally, in the tropics,

practically at sea-level as in Hongkong, where the reservoirs are its breeding places. In S. India I have seen the imago during the cooler months of the year, hawking in the streets of Coimbatore at an altitude of 1400 feet, but I

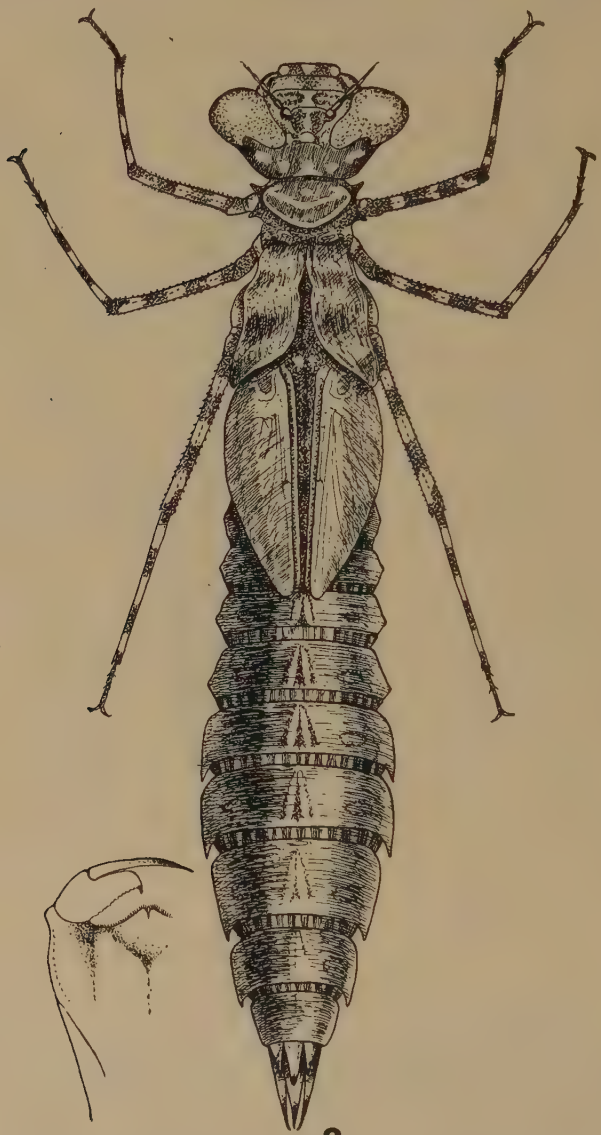

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Fig. 8.—Larva of *Cephalaeshna orbifrons* Selys. Labial mask inset.

have never found it breeding there; 3500 feet appears to be the lowest altitude at which larvae can be found and it becomes increasingly common until an altitude of 7250 feet is attained. In the sluggish channels cut through the peaty bogs of the kundahs (grassy moors) of the Nilgiris, S. India, I have found

the larvae in great numbers, the muddy bottoms being criss-crossed with their tracks. Emergence takes place during the night, and flight just at dawn. As larvae can be taken of all sizes and instars at any one time, I am led to infer that its life-history extends over two or three years. It is a strong pugnacious larva, and a not too pleasant insect to handle owing to its sharp spines.

Cephalaeshna orbifrons Selys (fig. 8).

Length of abdomen 23 mm. Length of body 35 mm. Hind femur 7 mm.

A remarkably narrow and elongated larva with strongly contrasted markings and striped legs. Head large, pentagonal in shape with the large pyriform eyes forming the antero-lateral angles. Antennae filiform, scape very short, thick, pedicel half as long again but more slim, remaining segments thin, the 3rd the longest and about twice the length of pedicel; ocelli distinct. Pale spots are present on the middle of the clypeus, a row of three on the labium and a row of five on the occiput. Labial mask narrow and elongate, tapering towards the mentum, without setae: middle lobe produced cone-like, the tip of the cone rather deeply cleft, the free border fringed with closely-set, short setae. Lateral lobes robust, moderately short, apical end squared and with inner apical angle produced as a robust tooth, and inner border furnished with small obtuse teeth. A long movable hook on its outer side. Sides of mask on dorsal surface with a row of very fine spines. Prothorax with a broadly arched prominent ridge posteriorly and with two robust divaricate spines on each side: thorax narrow, elongate, the pleural plates much undulated. Wing pads nearly parallel, closely apposed to the sides of the body, extending as far as segment 4. Legs very long and slim, both femora and tibiae marked with strongly defined dark annules: femora with three rows of short coral-like spines: tarsi and claws dark. Abdomen very narrow at base, broadening club-like to as far as segment 7, after which it tapers evenly and rapidly to the end which is formed by the closely-apposed appendix dorsalis and cerci in the form of a stout conical spine; segments 6 to 9 with robust backwardly directed lateral spines; segments 4 to 9 with mid-dorsal arrow-head-shaped markings; all intersegmental membranes coarsely striated. Anal appendages all tipped with black.

Habitat. In weedy sluggish streams. The specimen from which this description was taken is from Manipur, Assam, and was taken by Dr. S. Kemp. The imago has been taken in Assam, Burma, Bengal and Sikkim. The larva bears a strong resemblance to those of *Gynacantha*, but differs by the absence of setae on the mask: it is the first of this archaic group to be described.

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41, Queen's Gate, S.W.7

1943.

WEDNESDAY, October 6
„ November 3
„ December 1

1944.

„ January 19 (ANNUAL MEETING)
„ February 2

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